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STOCK ASSESSMENT AND BIOLOGICAL CHARACTERISTICS OF LAKE TROUT POPULATIONS IN INTERIOR ALASKA, 1987[1]

By

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ABSTRACT

Stock assessment of lake trout *Salvelinus namaycush* populations in central Alaska continued in 1987. Lake trout were sampled from Paxson and Summit Lakes of the Copper River system and from Fielding, Twobit, Sevenmile, and Landlocked Tangle Lake of the Tanana River system. Size composition of lake trout estimated as relative stock density varied widely between the lakes. Most lake trout of large size (greater than 780 millimeters fork length) were found in Paxson and Summit Lakes. A single fish in this size category was captured from Landlocked Tangle Lake. All other lake trout sampled from the Tanana River system were smaller, with most less than 500 millimeters. Ages of lake trout determined with otoliths (sagitta) ranged from 0 to 36 years, with most between 4 and 20 years. No fish greater than age 14 were found in Fielding and Sevenmile Lakes. Age at which 50 percent of all lake trout were mature ranged from 4.8 years for males in Paxson Lake to 10.5 years for females in Twobit Lake. Males typically matured at younger ages than females. Length at which 50 percent of lake trout were mature ranged from 335 millimeters for males in Twobit Lake to 457 millimeters for females in Paxson Lake.

Population abundance of lake trout was estimated with mark-recapture experiments in three lakes located in the Tanana River drainage. The abundance of lake trout greater than 250 millimeters was estimated to be 673 (21 fish per hectare) in Sevenmile Lake and 3,433 (15.7 fish per hectare) in Landlocked Tangle Lake. The abundance of lake trout greater than 350 millimeters in Twobit Lake was estimated to be 945 (15.7 fish per hectare). The density of lake trout of mature size was estimated to be 12.4 fish per hectare in Sevenmile Lake, 9.7 fish per hectare in Twobit Lake, and 7.5 fish per hectare in Landlocked Tangle Lake.

KEY WORDS: Lake trout, *Salvelinus namaycush*, population abundance, age, growth, maturity, yield, Sevenmile Lake, Twobit Lake, Landlocked Tangle Lake, Paxson Lake, Summit Lake, Fielding Lake.

INTRODUCTION

Lake trout *Salvelinus namaycush* support important recreational fisheries in both roadside and remote waters. Most fishing for lake trout occurs on easily accessible waters. However, since lake trout are often considered a trophy species, anglers seek guided and other fly-in fishing opportunities in remote areas of the state. Since 1977, the statewide harvest of lake trout has increased at an average annual rate of 3% (Mills 1986). Over one-third of the total harvest comes from lakes located in the Tanana River drainage and the Glennallen area. In the Glennallen area, harvest has remained at a level of 7,000 to 8,000 lake trout annually since 1977. In the Tanana River drainage and the Arctic-Yukon-Kuskokwim region (AYK), lake trout harvests have increased 5% annually.

Due to a number of biological attributes, lake trout populations may be easily overharvested. This species is long lived and slow growing. Records of fish older than 25 years are not unusual, and lake trout older than age 50 have been captured in Alaska. A trophy size lake trout weighing 8.7 kg (20 lbs) in Alaska would typically be 20 or more years old. In interior Alaska, lake trout spawn for the first time at age 5 to 10 at fork lengths (FL) of 350 mm to 500 mm (14 to 20 in). Mature lake trout do not spawn every year. Healey (1978) suggests that average maximum sustainable yield of lake trout populations is less than 0.5 kg of fish per surface hectare of lake per year.

Burr (1987a) found that the present knowledge of population abundance, size structure, population dynamic rates, and harvest levels for Alaska lake trout populations is limited. Based on harvest estimates (Mills 1986) and the average size of lake trout obtained from creel sampling and test netting, he found that the maximum sustainable harvest rate was being exceeded for all populations in the Tanana River drainage and Glennallen area for which harvest estimates were available. Harvest in these waters was as much as seven times the recommended maximum sustainable yield (Healey 1978). Based on this information, the Alaska Board of Fisheries reduced bag limits from 12 to 2 fish per day in all waters in the Tanana River drainage and Glennallen area. In addition, a minimum length limit of 450 mm total length (TL) (18 in) was included for several high use roadside lakes. For the Tangle Lakes system, which has sustained the highest harvest rates of any lake trout fishery in Alaska in recent years, a more restrictive one fish daily bag limit and a 450 mm minimum length limit was instituted.

This research project began in 1986. The long term goal was to quantify dynamic rates of lake trout populations in Alaska to accurately estimate sustainable yield for lake trout fisheries. However, the experience of management of lake trout fisheries in North America is that estimates of sustainable yield are decades in the making. Therefore, the short term goal of this program is to refine our ability to promulgate effective regulations for fisheries in interior Alaska which will keep harvests at or below levels shown to be sustainable for other lake trout populations (see Healey 1978). In pursuit of this goal, populations were sampled, fisheries were monitored, and angler attitudes were surveyed regarding various management options.

The specific project objectives during the 1987 field season were:

1. to estimate population abundance of lake trout larger than 250 mm (FL) in Sevenmile, Twobit and Landlocked Tangle Lakes;

2. to estimate the age composition, proportional stock density (Gablehouse 1984), and sex composition of the lake trout populations in Sevenmile, Landlocked Tangle, Twobit, Paxson and Summit Lakes;

3. to estimate age at maturity (AM_{50}) and length of maturity (LM_{50}) of both sexes of lake trout in Sevenmile, Landlocked Tangle, Twobit, Fielding, and Paxson Lakes;

4. to estimate the age composition, proportional stock density (Gablehouse categories), and sex composition of the lake trout harvested in sport fisheries at Paxson, Summit, and Fielding Lakes; and,

5. to estimate the mean length at age for populations of lake trout in Sevenmile, Twobit, and Landlocked Tangle Lakes and of harvests of lake trout from Paxson, Summit, and Fielding Lakes.

METHODS

Data were collected from populations of lake trout from six lakes in central Alaska: Paxson and Summit Lakes of the Copper River drainage and Fielding, Twobit, Sevenmile, and Landlocked Tangle Lakes in the Tanana River drainage. The lakes range widely in size from Sevenmile (surface area 32 ha) to Summit Lake (surface area 1,650 ha) (Figure 1). All lakes are located in the Alaska Mountain Range at elevations from 778 m to 1,006 m, and with the exception of Paxson Lake, within alpine tundra/scrub birch habitat. Paxson Lake is surrounded by a mixed spruce forest.

Population Abundance Estimates

Mark-recapture experiments were conducted to estimate the population abundance of lake trout in Sevenmile Lake, Twobit Lake and Landlocked Tangle Lake during 1987. A modified Petersen mark-recapture estimator was selected (Chapman 1951) to estimate the population abundance of lake trout larger than 250 mm FL in the three lakes. Population abundance and the approximate variance of this estimate were calculated with the following formulas (Seber 1982):

$$(1) \qquad \hat{N} = \frac{(C+1)(M+1)}{(R+1)} - 1; \text{ and,} \qquad (2) \quad \hat{V}[N] = \frac{(M+1)(C+1)(M-R)(C-R)}{(R+1)^2(R+2)};$$

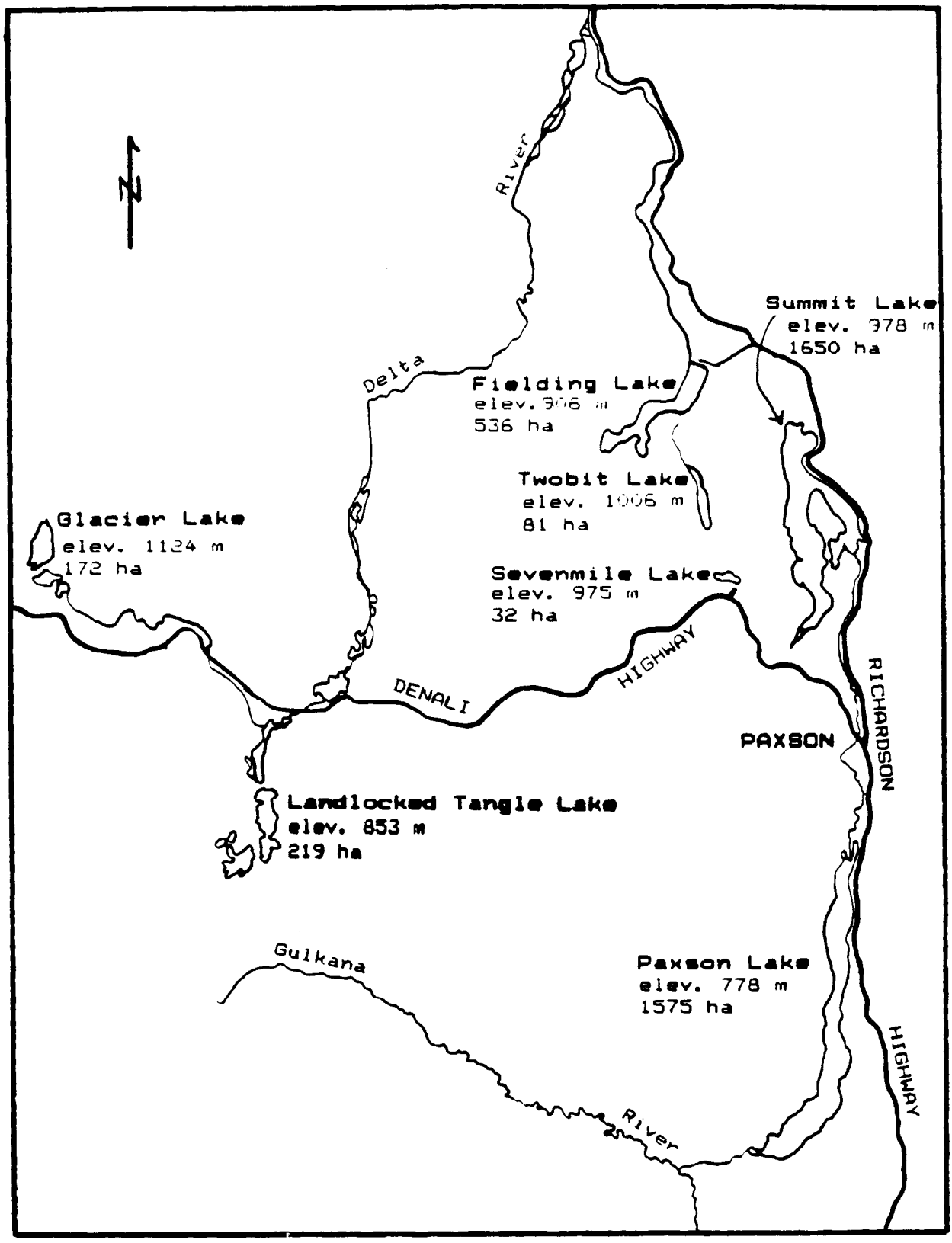

Figure 1. Map of the study area near Paxson, Alaska. Elevations of lakes are given in meters and approximate surface areas are in hectares.

where:

M = the number marked during the first period;

C = the number captured during the second period; and,

R = the number captured during the second period with marks from the first period.

Conditions for the accurate use of the Petersen mark-recapture estimator include (Seber 1982):

1. a closed population (no change in the number of fish in the population during the experiment);

2. all lake trout have the same probability of capture in the marking sample or in the recapture sample, or marked and unmarked lake trout mix completely between marking and recapture events;

3. marking of lake trout does not affect their probability of capture in the recapture sample;

4. lake trout do not lose their mark between the marking and recapture events; and,

5. all marked lake trout are reported when recovered in the recapture sample.

In all sampled lakes, efforts were made to meet these requirements. To promote mixing, marked fish were released throughout the lake. To measure tag loss, all fish were given a finclip as well as a numbered tag. In addition, the length of time between the capture events (> 1 month) should have been sufficient to ensure complete mixing of marked and unmarked fish.

To minimize differential mortality between marked and unmarked fish, only fish which appeared to be in good condition were released. Marked fish were released throughout the lake to enhance mixing of marked fish with the unmarked population. Also, tagged fish were marked with an adipose finclip to ensure that any bias in the abundance estimate due to tag loss was measurable. To evaluate recruitment through growth between the marking period and the subsequent capture period, a nonparametric method of testing for recruitment was used (Robson and Flick 1965).

The hypothesis of equal probability of capture for fish of different sizes was tested with contingency table analysis. The data were grouped by length classes. The test involves the frequencies of tagged fish recaptured versus those not recaptured by size group (Seber 1982). The hypothesis was also tested with the Kolmogorov-Smirnov two-sample test (Conover 1980).

Sevenmile Lake:

Sevenmile Lake is located at an elevation of 975 meters and the lake is located adjacent to the Denali Highway (Figure 1). The estimated surface area of the lake is 32 ha and the maximum recorded depth is 12.5 m. There are no active inlet or outlet streams, so it is closed to immigration and emigration. Between 16 and 29 June, lake trout were captured with 5 panel variable mesh sinking gill nets (13 mm, 25 mm, 38 mm, 50 mm, 64 mm square measure), baited hoop nets, fyke nets, and a 20 mm x 10 m x 76 m purse seine. Gill nets were checked at 1/2 to 3 hour intervals except for overnight sets which ran from approximately 2400 hr to 1000 hr. The hoop nets were baited with cut herring *Clupea harengus* which was placed in perforated bait containers. Nets were set in all parts of the lake in various depths from 0.5 m to more than 12 m.

During a second sampling event (22 through 30 July), lake trout were captured with variable mesh gill nets, baited hoop nets, and fyke nets. All portions of the lake were netted as were various depths. To minimize mortality of lake trout, gill nets were checked at half hour intervals. No loss of tags was observed and no recruitment through growth was detected with the nonparametric test of Robson and Flick (1965).

Twobit Lake:

The estimated surface area of Twobit Lake is 81 ha, and the maximum depth is 23 m. The lake is located at an elevation of 1,006 meters (Figure 1). There are numerous small inlets which drain the hillsides around the lake. A single outlet flows from the north end of the lake to Fielding Lake approximately 2.5 km downstream. The steep gradient of this stream provides a barrier to fish passage upstream into Twobit Lake. However, it is possible that lake trout could have left the lake between the first and second sampling periods. From 24 to 27 June and 22 to 31 July, lake trout were captured with variable mesh sinking gill nets, baited hoop nets, and by angling. Gill nets were checked at 1 to 3 hour intervals except for overnight sets which ran from approximately 2100 hr to 1100 hr. A second sampling event was conducted from 25 August through 1 September. Variable mesh sinking gill nets, "tooth" nets (25 mm x 3 m x 46 m sinking gill nets) and baited hoop nets were used to capture lake trout. To minimize mortality of lake trout, gill nets were checked every half hour.

Nets were set in all parts of the lake in various depths from 0.5 m to more than 20 m. No recruitment through growth between the two sampling periods was found for lake trout greater than 250 mm FL. One of the lake trout captured during August lost its Floy tag from June or July, but since all tagged fish were also marked with an adipose finclip, the fish was recognized as a recapture. However, some bias associated with length of captured fish did occur. Only one fish less than 350 mm FL was recaptured (5% recapture rate) during August (Figure 2), while 72 of the marked fish were in this 200-350 mm length category (31%). The length compositions of fish marked in June and July and fish examined during August are similar with 31% and 40%, respectively in the 200-350 mm length category. During June and July, most (67%) of the lake trout were captured in baited hoop nets. In contrast, during August, 66% of the fish were captured in gill nets (Figure 3).

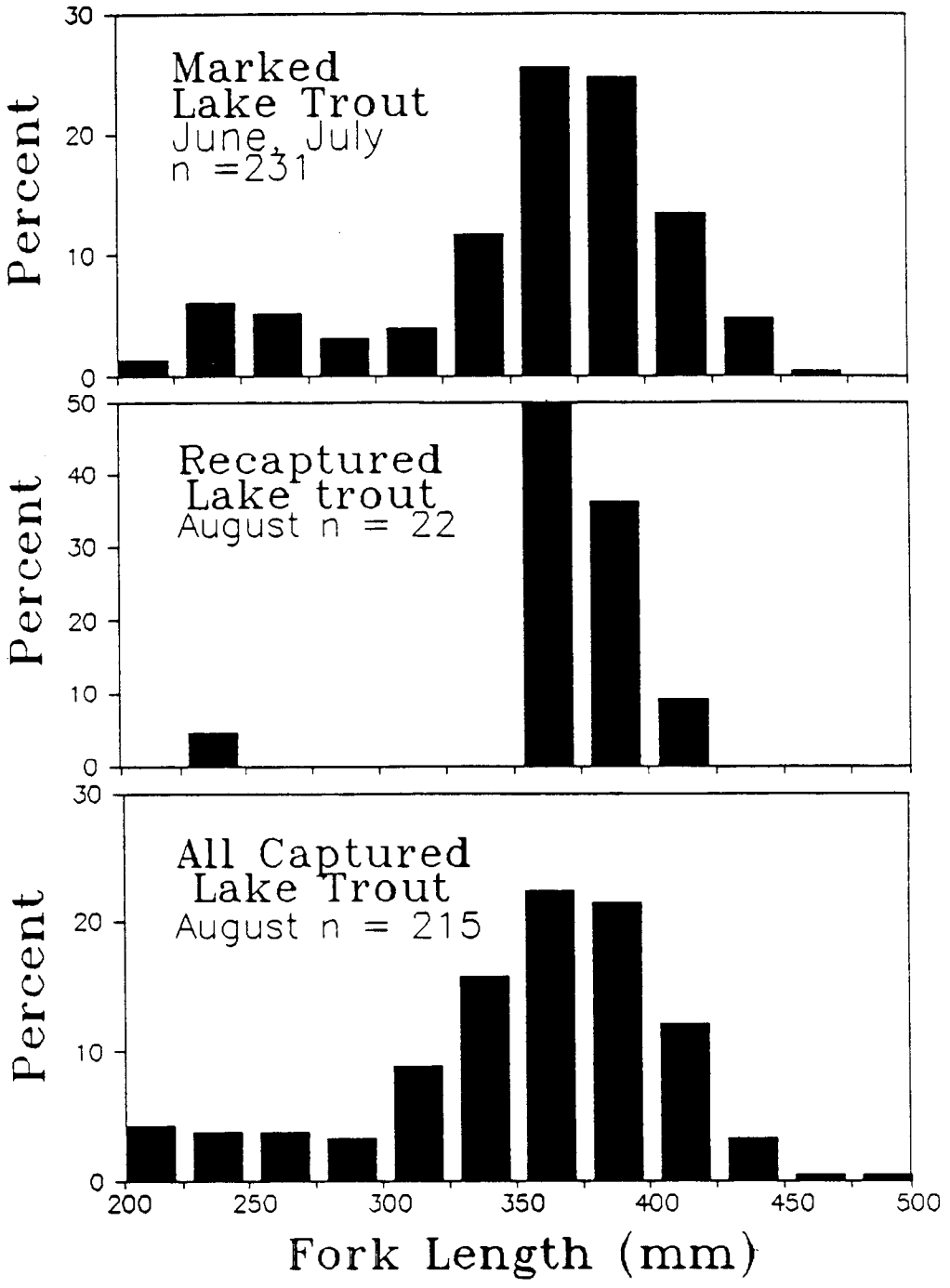

Figure 2. Percent length frequencies of lake trout captured from Twobit Lake during population abundance estimate sampling, 1987.

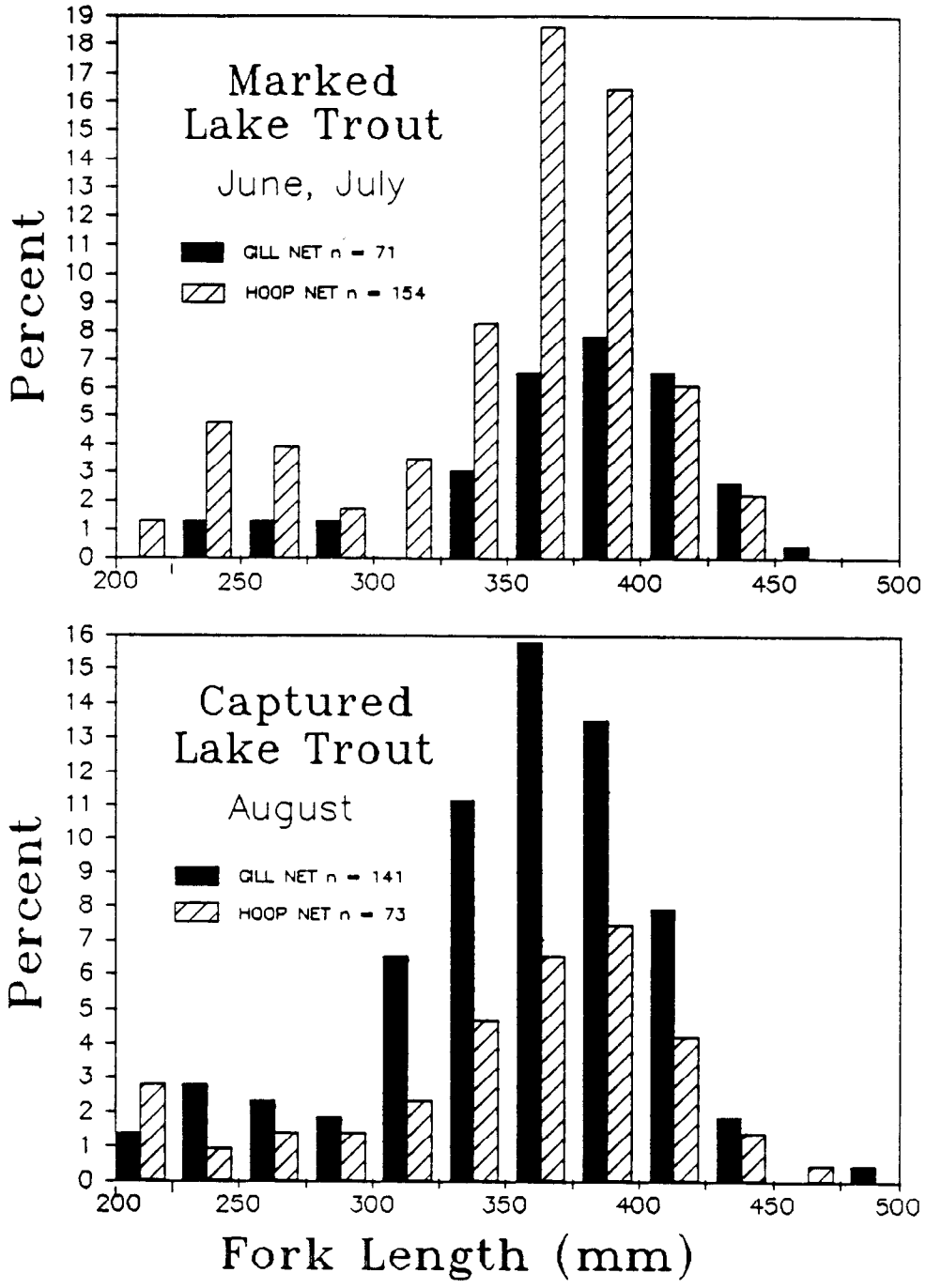

Figure 3. Percent length frequencies of lake trout captured by gear type from Twobit Lake during population abundance estimate sampling, 1987.

Although the effort with hoop nets during the two sampling periods was comparable (215 net nights in June-July; 275 net nights in August), the hoop nets were not as effective at capturing lake trout in late August. The movement of lake trout into shallow water as spawning season approached is a probable explanation for the decline in efficiency of hoop traps and the increase in efficiency of gill nets. Seventy-five percent of the fish caught in hoop nets in August were captured during the first 4 days of this 11-day sampling period. The percentage of small lake trout (200-350 mm) captured in gill nets (65%) in August is similar to the percentage of all lake trout captured in gill nets (66%) during the August sampling period (Appendix Table III.1). Hence, the dearth of small lake trout recaptured cannot be attributed solely to the reduced effectiveness of the baited hoop nets. The lack of recaptured small lake trout may be a factor of the small sample size (relative to the actual population abundance) or may be due to higher mortality of fish marked in this length category. If increased mortality of small fish did occur, the assumption of equal mortality between marked and unmarked fish was not valid. To avoid bias, whatever the cause, those fish less than 350 mm were not included in the estimate for the Twobit Lake population. Additional sampling is planned in 1988 to obtain additional recaptures of fish in the 200-350 mm size group.

Landlocked Tangle Lake:

Landlocked Tangle Lake is located at an elevation of 853 meters within the Tangle Lake system (Figure 1). The estimated surface area is 219 ha, and the maximum recorded depth is 40 m. There are a few small inlet streams which drain the surrounding hillsides. There are no outlets. Between 23 June and 9 July, lake trout were captured with variable mesh sinking gill nets, baited hoopnets, fyke nets, and a purse seine which was also used as a beach seine. Gill nets were checked at 1 to 3 hour intervals except for overnight sets which ran from approximately 2400 hr to 0800 hr. Nets were set in all parts of the lake in various depths from 0.5 m to more than 25 meters. During a second sampling period (6 to 24 August), lake trout were captured with variable mesh sinking gill nets, baited hoop nets, and the purse seine. In addition, trot lines with hookless bait were used to capture lake trout. To keep netting mortality to a minimum, gill nets were checked every half hour. All portions of the lake were netted as were various depths.

During the second sampling event, no loss of tags was observed. However, plots of length frequencies of lake trout captured during the two sampling periods indicated recruitment through growth of individual fish had taken place (Figure 4). Growth recruitment of fish less than 250 mm was confirmed by the Robson and Flick (1965) test. Due to the small sample size and to apparent problems with recruitment through growth, fish less than 250 mm were not included in the estimate. In addition to growth recruitment, another source of bias in the size distribution of fish captured during the two sampling periods was detected. Trot lines were used only during the second sampling period and lake trout captured on trot lines were larger than fish captured with other gear types. Further, the recapture rate for lake trout caught on trot lines was 36%; two times the recovery rate of the next highest gear type. Therefore, the difference in size distribution detected between

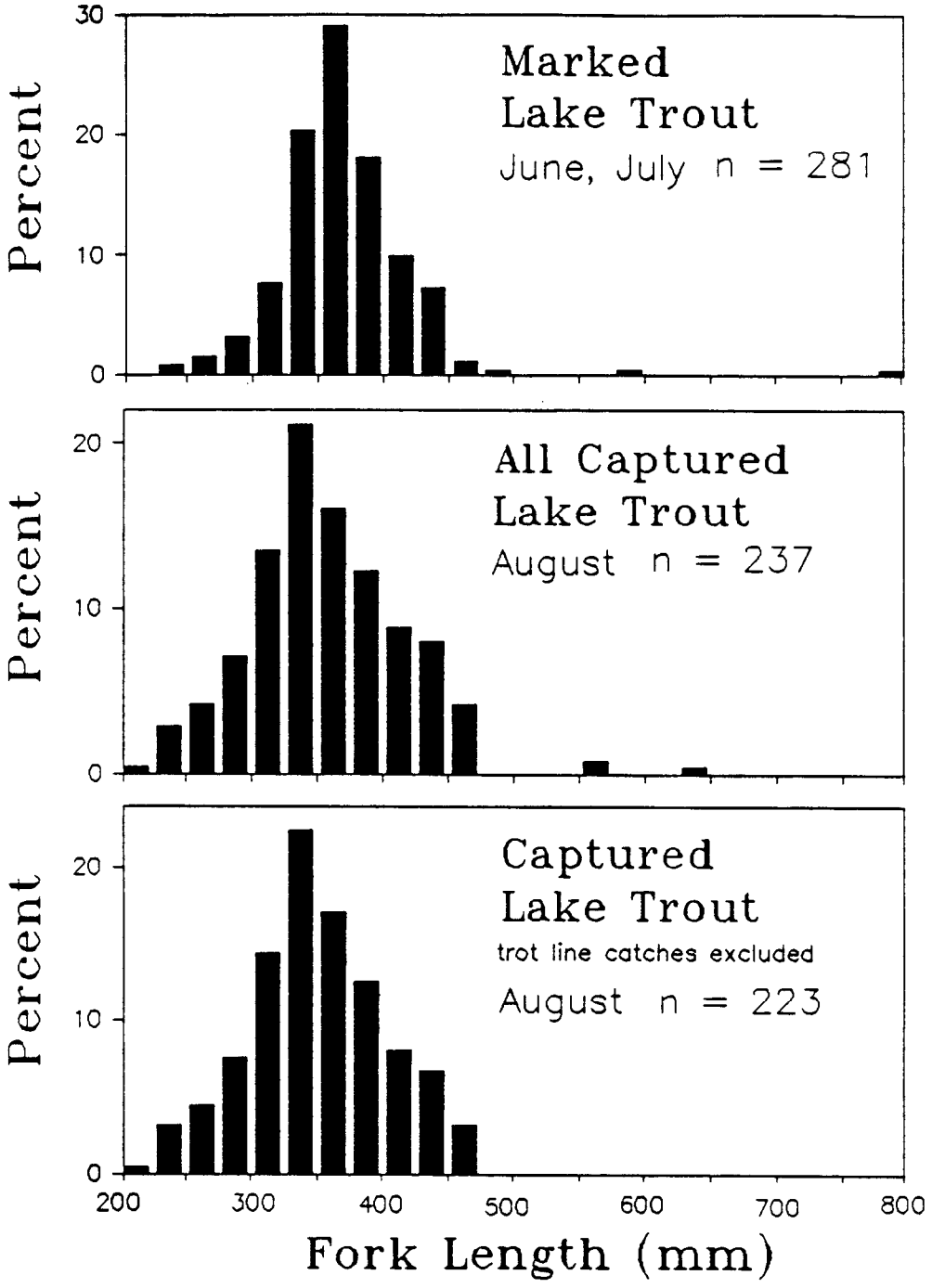

Figure 4. Percent length frequencies of lake trout captured from Landlocked Tangle Lake during population abundance estimate sampling, 1987.

the two sampling periods has at least two sources; (1) the use of trot lines only during the second sampling period, and (2) recruitment through growth.

Population Structure

Age, weight, length, sex, and maturity data were obtained from the lake trout populations from all six study lakes. When a lake trout was captured in good condition, it was measured to the nearest millimeter FL and tagged with an individually numbered Floy anchor tag. When killed, lake trout were weighed and dissected to obtain otoliths for age determination and to obtain information on sex and maturity. These data were obtained from a number of sources including:

Creel Census. Information on length, weight, age, sex, and maturity were obtained from lake trout sampled from the creel. Creel censuses were conducted at Fielding, Paxson, and Summit Lakes.

Burbot Project. Lake trout caught in baited hoop nets (which were set by the lake burbot project personnel) in Fielding, Summit, Paxson, Sevenmile, and the Tangle Lakes were sampled for length and age data.

Population Estimates. Lake trout captured during the mark-recapture experiments at Landlocked Tangle, Sevenmile, and Twobit Lakes provided data on length, weight, age, sex, and maturity for these lake trout populations.

Paxson Lake Egg Take. During September, lake trout were captured at spawning sites in Paxson Lake with multifilament gill nets. Information on length, weight, age, sex, and maturity was obtained from these fish.

Age Determination:

Otoliths (sagitta) were collected from all lake trout dissected during the various field activities. Whole otoliths were prepared by hand grinding surfaces on a carborundum honing stone and were viewed with a compound microscope under reflected light. Sets of opaque and hyaline bands were counted as years of growth with the hyaline bands used as "annuli".

A scale sample was taken from all lake trout handled during various project activities. Scales were cleaned and placed between glass slides and were viewed with a microfiche projector. The criteria described by Cable (1956) were used for determining annuli.

All age and growth data presented in this report are based on ages obtained from otoliths. Sharp and Bernard (1988) found that scales provided lower estimates of age than did otoliths, particularly for lake trout older than age 5. The estimates of age obtained from the scale samples are not presented in this report. They will be used for validation of age determination with tagged lake trout recaptured in future years.

Sex and Age Composition and Relative Stock Density:

The proportions of the populations corresponding to each sex, age and size category were estimated with the following formulas (Cochran 1977):

$$(3) \qquad \hat{p}_j = \frac{n_j}{n}; \text{ and,} \qquad (4) \quad V[\hat{p}_j] = \frac{\hat{p}_j(1-\hat{p}_j)}{n-1};$$

where:

n_j = the number in the sample from group j;

n = the sample size; and,

p_j = the estimated fraction of the population that is made up of group j.

When gear bias was detected, the proportion of the populations corresponding to each sex, age, and size category were estimated with formula (5) and the approximate variance was calculated with formula (6) (from the Delta method, Seber 1982):

$$(5) \qquad \hat{p}_j = \frac{\Sigma\ \hat{p}_{ij}\ \hat{N}_i}{\Sigma\ N_i}; \text{ and,}$$

$$(6) \qquad V[\hat{p}_j] = \Sigma\ V[\hat{p}_{ij}] \left(\frac{\hat{N}_i}{N}\right)^2 + \frac{\Sigma\ V[\hat{N}_i]\ (\hat{p}_{ij} - \hat{p}_j)^2}{N^2}$$

where:

p_{ij} = the estimated fraction of the population that is made up of group j in strata i; and,

N_i = the estimated population abundance in strata i.

Relative Stock Density (RSD) was estimated for lake trout from the samples from each lake. The categories of Stock, Quality, Preferred, Memorable, and Trophy were determined as outlined by Gablehouse (1984).

Length at Maturity and Age of Maturity:

The length and maturity of the sampled lake trout were recorded as percent mature in length categories. Since more than one length category generally had mature and immature fish, probit analysis was used to estimate the LM_{50} (the length at which 50% of the fish are mature; Finney 1971). The procedure PROBIT from SAS Institute Inc., Cary, NC 27511 was used for this analysis.

The age of maturity, AM_{50}, was estimated using the same procedures as described in the previous paragraph, except that ages rather than lengths were used as variables. The same samples were used for both analyses.

Size at Age:

Estimates of mean length and mean weight at age were generated with standard normal procedures. Simple averages and squared deviations from the means were used to calculate means and variances of the means.

RESULTS

Population Abundance Estimates

Mark-recapture experiments were completed and abundance estimates were made for the lake trout populations from Sevenmile Lake, Twobit Lake, and Landlocked Tangle Lake.

Sevenmile Lake:

During the first sampling period in June and July, 29 lake trout were caught in gill nets, 24 were caught in fyke nets, 2 in hoop nets and 26 in the purse seine; a total of 81 lake trout. Seventy-six were captured in good condition, tagged, and released; the rest (five) were killed by the sampling gear (Table 1). During the second sampling period in late July, 144 lake trout were captured in gill nets, 12 lake trout were caught in fyke nets and 3 in hoop nets. Of the 159 lake trout examined during the second sampling period, 18 had tags from previous sampling periods. One hundred twelve were captured alive, tagged, and released and 29 died in the sampling gear.

No significant difference between capture rates among length categories (25 mm intervals; 200-500 mm) was found ($\chi^2 = 0.04$, df = 1, P ¢ 0.95). Therefore, a nonstratified abundance estimate was calculated for Sevenmile Lake. The estimated abundance of lake trout larger than 250 mm FL in Sevenmile Lake was 647 fish (SE = 118). Since the surface area of Sevenmile Lake is 32 ha (80 acres), the estimated density of lake tout in the lake was 20.2 lake trout per hectare (8.1 LT/acre).

Twobit Lake:

During the first sampling period in June and July, 131 lake trout were caught in gill nets, 157 in hoop nets, and 6 with rod and reel; a total of 294 lake trout. Two hundred thirty-one were captured in good condition, tagged and released; the rest (63) were killed by the sampling gear. During the second sampling period in August and early September, 141 lake trout were captured in gill nets, 73 in hoop nets, and 1 on rod and reel. Of the 215 lake trout examined during the second sampling period, 22 had tags from the first sampling period; 174 were captured alive, tagged, and released; and 19 were killed by the sampling gear.

Table 1. Estimated abundance of lake trout larger than 250 mm FL in Sevenmile Lake, 1987.

Gear	Number of Lake Trout			Abundance		Lake Trout per Hectare
	Marked	Recaptured	Examined	Estimate	SE	
Gill Net	24	18	144			
Fyke Net	24	0	12			
Hoop Net	2	0	3			
Purse Seine	26	0	0			
Total	76	18	159	647	118	20.2

No significant difference between capture rates among length categories (25 mm intervals, 200-500 mm) was detected ($\chi^2 = 0.58$, df = 1, $P > 0.9$); hence a nonstratified abundance estimate was calculated for Twobit Lake. However, only one lake trout less than 350 mm was recaptured compared to the 72 lake trout marked in the 200-350 mm category (Figure 2). Therefore, only the abundance of lake trout greater than 350 mm was estimated.

One hundred fifty-nine lake trout greater than 350 mm were marked during the first sampling period in June and July (Table 2). In August, 129 lake trout greater than 350 mm were examined of which 21 had tags from the first period. The estimated abundance of lake trout larger than 350 mm FL in Twobit Lake was 945 (SE = 167). Since the surface area of Twobit Lake is 81 ha (200 acres), the estimated density of lake trout in the lake was 11.7 lake trout per hectare (4.7 LT/acre).

Landlocked Tangle Lake:

During the first sampling period in June and July, 280 lake trout were caught in gill nets, 6 were caught in fyke nets, 22 in hoop nets, and 52 with the seine; a total of 360 lake trout. Two hundred fifty-nine were captured in good condition, tagged, and released. The rest (101) were killed by the sampling gear. During the second sampling period in August, 164 lake trout were captured in gill nets, 18 were caught in hoop nets, 40 were caught with the seine, and 15 were caught on the hookless trot lines. Of the 229 lake trout examined during the second sampling period, 18 had Floy tags from the first sampling period; 211 were captured alive, tagged, and released; and 26 were killed by the sampling gear.

The Kolmogorov-Smirnov two-sample test showed no significant difference (DN = 0.295; P = 0.21) between the cumulative distribution of fork lengths of fish marked in June and July and of lengths of fish captured in August (Figure 4). However, contingency table analysis indicated that catch rates were higher ($\chi^2 = 4.60$, df = 1, $P < 0.05$) for fish larger than 400 mm FL than for fish less than 400 mm. Hence, fish were grouped by length class and a separate population abundance estimate was calculated for each group. Within the 250-400 mm size group, 208 lake trout were marked during the first sample period and 176 were examined during the second sample period, of which 11 were recaptured from the marked population (Table 3). Fifty-one lake trout larger than 400 mm were marked during the first sample period and 53 were examined during the second sample period, of which seven were recaptured from the marked population.

The estimated abundance of lake trout larger than 250 mm FL in Landlocked Tangle Lake was 3,433 (SE = 807). Since the surface area of Landlocked Tangle Lake is 219 ha (540 acres), the estimated density of lake trout in the lake was 15.7 lake trout per hectare (6.4 LT/acre).

Population Structure

Data on sex and age composition, relative stock density, size and age at maturity, and length at age were obtained from all lake trout populations

Table 2. Estimated abundance of lake trout larger than 350 mm FL in Twobit Lake, 1987.

Gear	Number of Lake Trout			Abundance		Lake Trout per Hectare
	Marked	Recaptured	Examined	Estimate	SE	
Gill Net	55	14	85			
Hoop Net	100	7	43			
Rod and Reel	4	0	1			
Total	159	21	129	945	167	11.7

Table 3. Estimated abundance of lake trout larger than 250 mm FL in Landlocked Tangle Lake, 1987.

Strata	Gear	Number of Lake Trout			Abundance		Lake Trout per Hectare
		Marked	Recaptured	Examined	Estimate	SE	
250 - 400 mm	Gill Net	133	3	127			
	Fyke Net	6	0	0			
	Hoop Net	22	0	14			
	Seine	47	6	34			
	Trot Line	0	2	1			
	Total	208	11	176	3,082	801	14.1
¢ 400 mm	Gill Net	43	2	32			
	Fyke Net	0	0	0			
	Hoop Net	3	1	2			
	Seine	5	1	6			
	Trot Line	0	3	13			
	Total	51	7	53	351	99	1.6
Total		259	18	229	3,433	807	15.7

sampled in 1987. These data were obtained both from creel surveys and from test netting.

Sex Composition:

The sex composition of lake trout harvested from Fielding, Paxson, and Summit Lakes was estimated using samples obtained from creel censuses (Table 4). Females were much more common than males in the sample from Fielding Lake (6:1). The ratio of females to males for lake trout harvested by anglers in Paxson Lake was 1:1. Males were more common in the creel from Summit Lake (1.5:1).

Proportions of males, females, and immature lake trout were also estimated using samples collected during test netting of the six lakes sampled during 1987 (Table 4). In Landlocked Tangle Lake, the ratio of males to females from all samples (n = 129) was essentially even (0.9:1). However, because of gear bias detected in this sample, a subsample (n = 22) collected during August was used to estimate sex composition of the Landlocked Tangle Lake population. The adjusted estimate is 69% males and 31% females (2.2:1). More males than females were sampled from Paxson (2.1:1) and Summit Lakes (2.3:1). Females were more common than males in the samples from Fielding (0.4:1), Sevenmile (0.6:1), and Twobit Lakes (0.6:1).

Relative Stock Density:

No lake trout sampled from the creel at Fielding, Paxson, or Summit Lakes were in the "Trophy" category (FL > 974 mm) (Table 5, Figure 5). A small portion of the lake trout sampled from Paxson Lake (2%) and Summit Lake (4%) were "Memorable" (779-974 mm FL). "Preferred" (595-778 mm FL) lake trout composed from 4% to 13% of the lake trout sampled from the creel from these lakes. The highest proportion of lake trout of "Quality" (495-594 mm FL) size and larger were harvested from Paxson Lake (48%).

The relative stock density estimates from Fielding, Paxson, and Summit Lakes are similar to those obtained from creel samples, except that the percentage of "Preferred" and larger fish from each lake is slightly lower in the test netting sample (Table 6 and Figure 6). Only one lake trout was captured in each of the "Preferred" and "Memorable" categories from Landlocked Tangle Lake. The RSD for the Landlocked Tangle Lake population was adjusted for gear bias and the estimate was made from those lake trout sampled during August. Lake trout of "Quality" size made up 1% or less of the fish sampled from Landlocked Tangle, Sevenmile, and Twobit Lakes. Most of the lake trout sampled from these three lakes (99%) were of "Stock" size (260-494 mm FL) or smaller.

Age Composition:

Age composition was estimated for lake trout harvested by anglers from Fielding, Paxson, and Summit Lakes. Age composition was also estimated for lake trout sampled during test netting from Landlocked Tangle, Paxson, Sevenmile, Summit, and Twobit Lakes.

Table 4. Sex composition of lake trout from Fielding, Landlocked Tangle, Paxson, Sevenmile, Summit, and Twobit Lakes, 1986-87.

Lake			Creel Sampling			Test Netting			Both		
			Males	Females	Immature	Males	Females	Immature	Males	Females	Immature
Fielding	n[1]	14	1	6	0	3	4	0	4	10	0
	%		14	86	0	43	57	0	29	71	0
	SE (%)		10	10	0	14	14	0	13	13	0
Landlocked	n	22	---	---	---	---	---	---	---	---	---
Tangle	%[2]					69	31	0	69	31	0
	SE (%)					10	10	0	10	10	0
Paxson	n	563	56	55	0	323	129	0	379	184	0
	%		50	50	0	71	29	0	67	33	0
	SE (%)		2	2	0	2	2	0	2	2	0
Paxson[3]	n	133	56	55	0	10	12	0	66	67	0
	%		50	50	0	45	55	0	50	50	0
	SE (%)		4	4	0	4	4	0	4	4	0
Sevenmile	n	58	---	---	---	18	32	8	18	32	8
	%					31	55	14	31	55	14
	SE (%)					6	7	5	6	7	5
Summit	n	206	9	6	0	126	56	13	135	58	13
	%		60	40	0	65	29	7	66	28	6
	SE (%)		3	3	0	3	3	2	3	3	2
Summit[3]	n	50	9	6	0	10	14	11	19	20	11
	%		60	40	0	29	40	31	38	40	22
	SE (%)		7	7	0	6	7	7	7	7	6
Twobit	n	142	---	---	---	53	89	0	53	89	0
	%					37	63	0	37	63	0
	SE (%)					4	4	0	4	4	0

[1] sample size

[2] adjusted for gear bias

[3] sex composition estimate without samples collected at spawning sites

Table 5. Relative Stock Density of lake trout harvested from Paxson, Summit, and Fielding Lakes (Gabelhouse 1984).

Lake		Length Group1				
		260 mm Stock	495 mm Quality	595 mm Preferred	779 mm Memorable	975 mm Trophy
Fielding	n	34	6	5	0	0
	%	76	13	11	0	0
	SE(%)	6	5	5	--	--
Paxson	n	71	46	18	3	0
	%	51	33	13	2	0
	SE(%)	4	4	3	1	--
Summit	n	14	9	1	1	0
	%	56	36	4	4	0
	SE(%)	10	10	4	4	--

1 Lower limit of length category

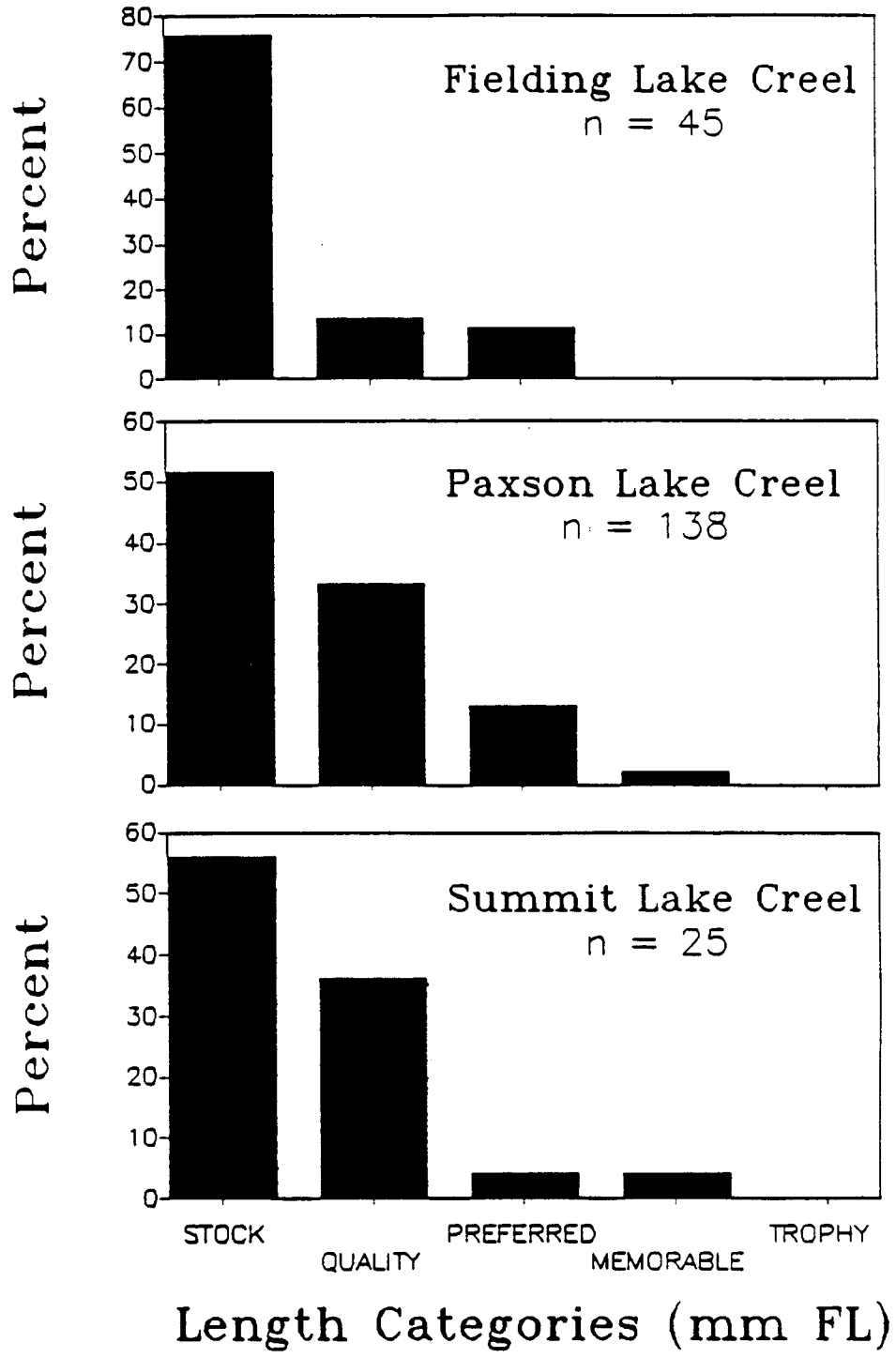

Figure 5. Relative Stock Density of lake trout harvested from the sport fisheries in Paxson, Summit, and Fielding Lakes, 1987.

Table 6. Relative Stock Density of the lake trout populations in Landlocked Tangle, Paxson, Sevenmile, Summit, and Twobit Lakes (Gabelhouse 1984).

Lake		Length Group[1] 260 mm Stock	495 mm Quality	595 mm Preferred	779 mm Memorable	975 mm Trophy
Fielding	n	83	12	6	0	0
	%	82	12	6	0	0
	SE(%)	4	3	2	--	--
Landlocked Tangle	n	--	--	--	--	--
	%[2]	99	0.4	0.2	0	0
	SE(%)	23	0.3	0.2	--	--
Paxson	n	293	231	75	7	0
	%	48	38	12	1	0
	SE(%)	2	2	1	0	--
Sevenmile	n	247	2	0	0	0
	%	99	1	0	0	0
	SE(%)	0.6	0.6	--	--	--
Summit	n	129	91	15	5	0
	%	54	38	6	2	0
	SE(%)	3	3	2	1	--
Twobit	n	537	1	0	0	0
	%	100	0	0	0	0
	SE(%)	0.2	0.2	--	--	--

[1] Lower limit of length category
[2] Adjusted for length bias

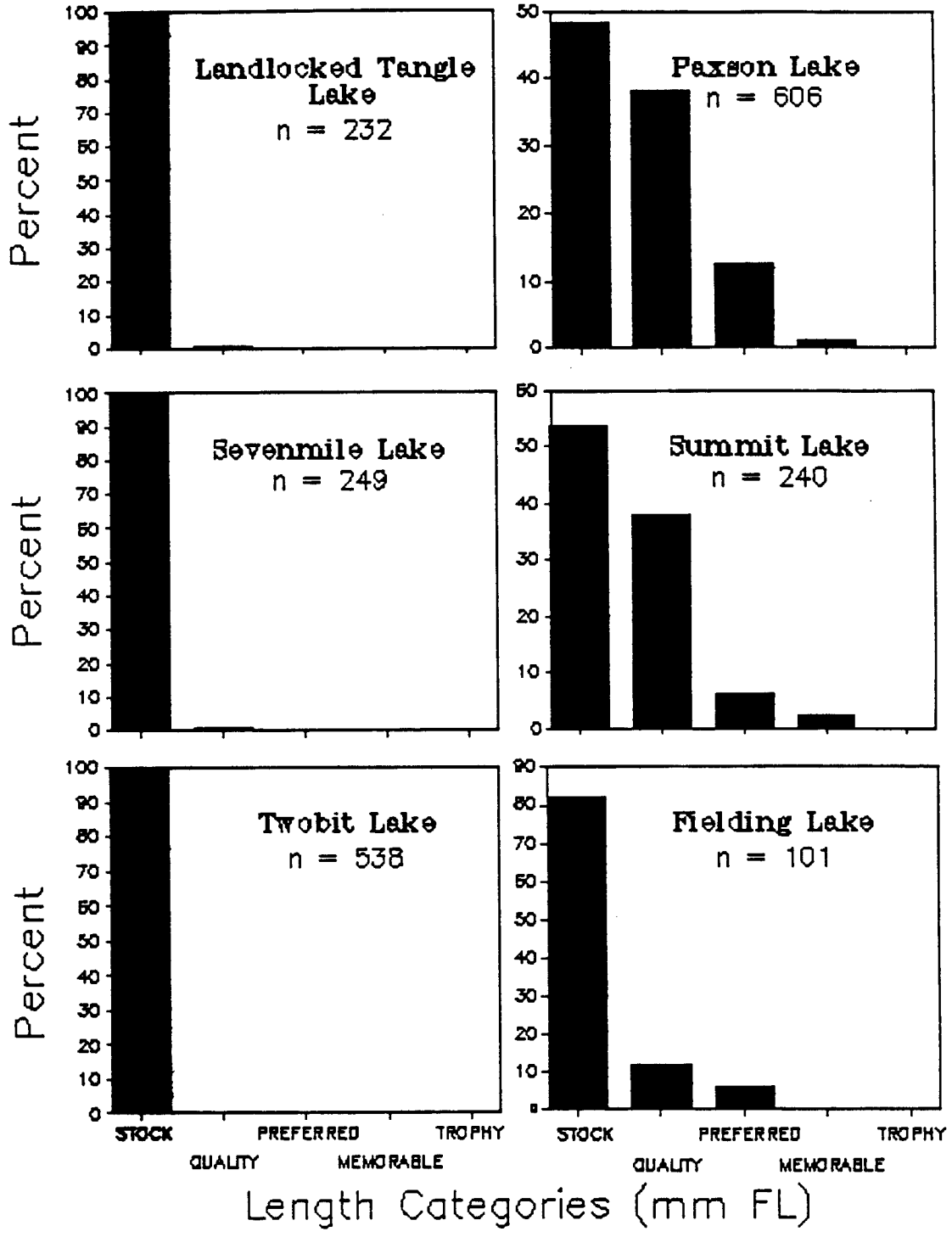

Figure 6. Relative Stock Density of the lake trout populations in Landlocked Tangle, Sevenmile, Twobit, Paxson, Summit, and Fielding Lakes.

A sample of 41 lake trout from the creel at Fielding Lake ranged from age 4 to age 13 (Figure 7; Appendix Table I.1). Nearly all (93%) of the fish in the sample were less than age 10. An additional sample of 11 fish captured with variable mesh gill nets and electrofishing gear were within the same age range (Appendix Table I.1).

One hundred thirty-four lake trout harvested by anglers from Paxson Lake ranged from age 4 to age 33 with most (58%) between the ages of 5 and 8 (Figure 7; Appendix Table I.2). These samples were combined with an additional sample of 95 fish captured with 25 mm and 38 mm mesh gill nets to estimate the age composition of the population of lake trout in Paxson Lake. Fish in this larger sample were within the same age range with 52% of the lake trout sampled between age 5 and 8 and 85% less than age 20 (Figure 8; Appendix Table I.2).

Twenty-six lake trout caught by anglers from Summit Lake ranged from age 4 through age 19 with most (74%) age 10 or less (Figure 7; Appendix Table I.3). A total of 107 lake trout sampled during test netting ranged from age 1 to 36. The age 1 and 2 fish were caught in fyke nets. The other fish in the test sample were caught in 25 mm, 38 mm, and variable mesh gill nets. Age groups 4 through 7 were most abundant (49%) in this combined sample, and 86% of the lake trout were less than age 20 (Figure 8; Appendix Table I.3).

Ages were determined from a sample of 129 lake trout from Landlocked Tangle Lake. These lake trout were captured with the various gears used for the population abundance estimate conducted at this lake. Fish in this sample ranged from age 1 to 26 with 55% of the lake trout sampled ranging from age 8 to age 11. Length bias of the sampling gear was detected during analysis of these data for the population estimate. Hence, only those samples which were collected during the second or recapture sampling event were used to estimate age composition of this population. The majority of the age samples came from the first sampling event so the estimate of population age composition is based on only 25 samples. The distribution of ages of all samples collected is shown in Figure 8 and the estimated population age composition is given in Appendix Table I.4. A large proportion of lake trout (66%) sampled from Landlocked Tangle Lake were age 10 or older.

Sixty-five lake trout captured in fyke nets and in variable mesh and 25 mm mesh gill nets from Sevenmile Lake ranged from age 0 to 14 (Figure 8; Appendix Table I.5). This is the only population sampled where a large number of lake trout less than age 4 (31%) were sampled. Age 6 lake trout are absent from the sample from Sevenmile Lake.

A sample of 155 lake trout captured in variable mesh, 25 mm, and 38 mm mesh gill nets from Twobit Lake ranged in age from 5 through 30. Age 12 was the most common age class (12%) in the sample (Figure 8; Appendix Table I.6). As with Landlocked Tangle Lake, older age classes (age 10 or older) made up a large proportion (67%) of the lake trout population in Twobit Lake.

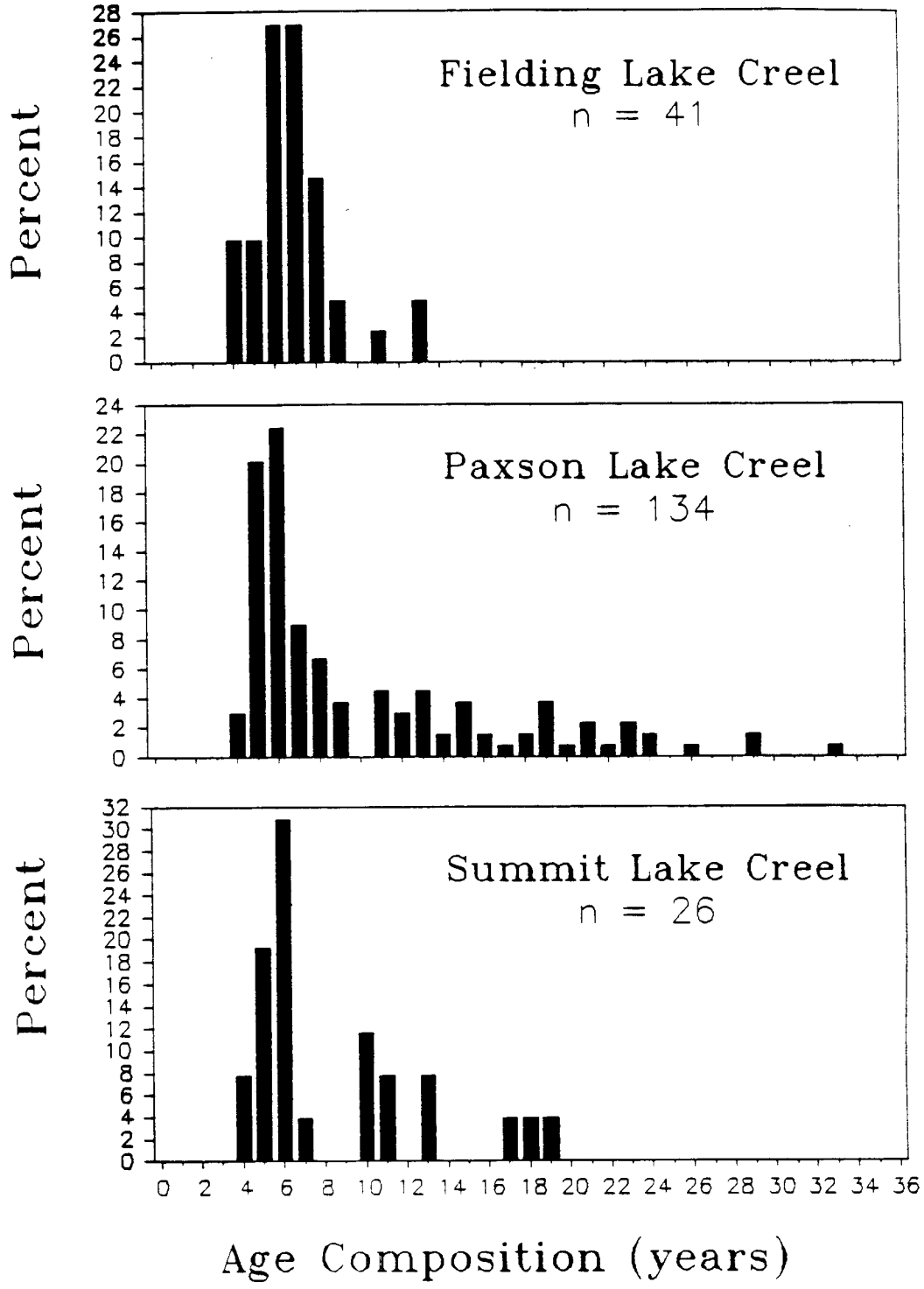

Figure 7. Estimated percent age composition of the lake trout harvested from the sport fisheries at Fielding, Paxson, and Summit Lakes, 1987.

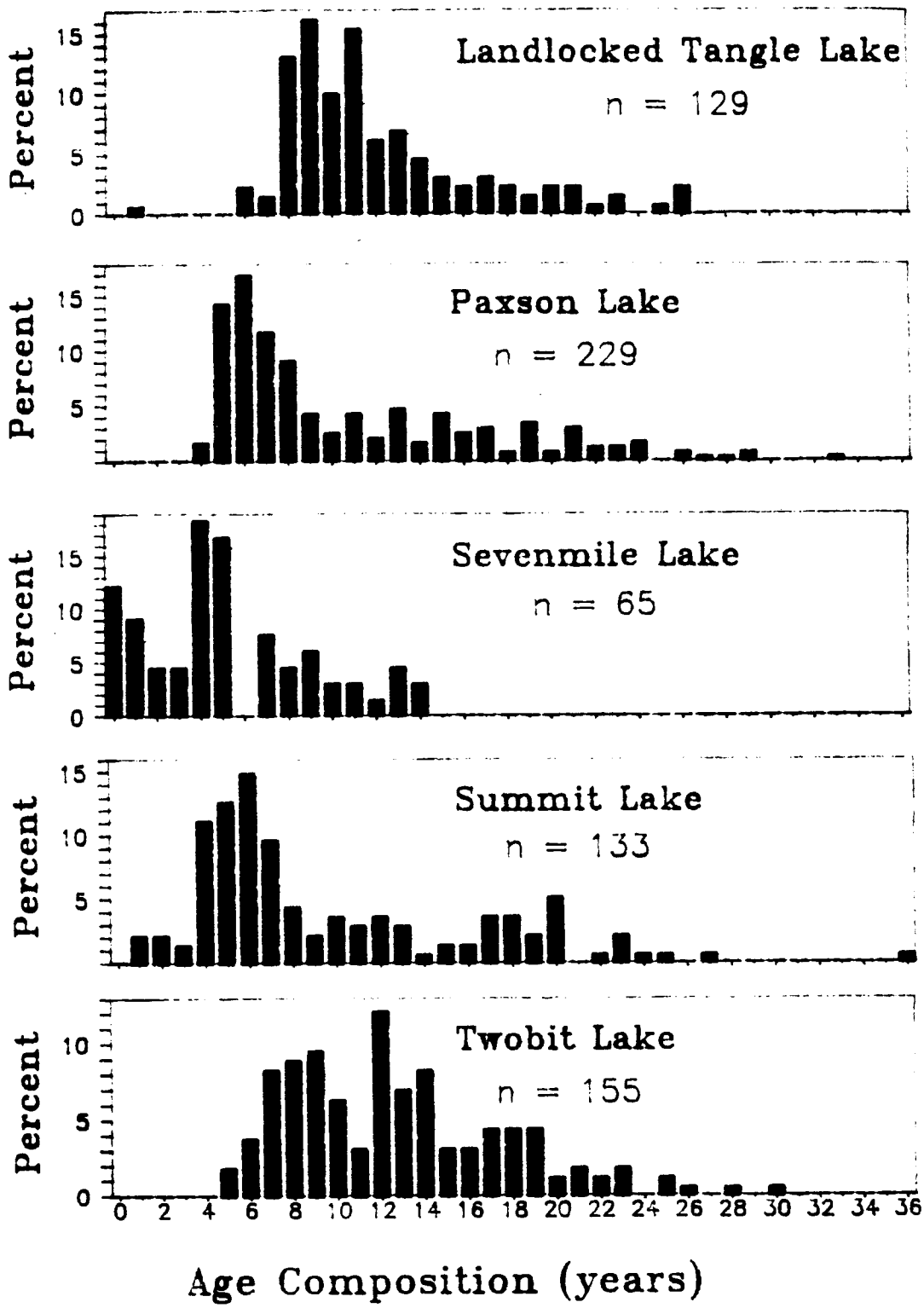

Figure 8. Estimated percent age composition of the lake trout populations in Landlocked Tangle, Paxson, Sevenmile, Summit, and Twobit Lakes, 1987.

Maturity:

Length at Maturity. Lake trout from Paxson Lake and Summit Lake mature at the largest size (LM_{50} = 394 mm and 396 mm FL, respectively) of any of the lakes sampled (Figure 9). Lake trout mature at a smaller size in the populations from Twobit Lake (LM_{50} = 363 mm FL), Sevenmile Lake (LM_{50} = 388 mm FL) and Landlocked Tangle Lake (LM_{50} = 357 mm FL). In Paxson, Summit, and Twobit Lakes, males matured at somewhat smaller sizes than females (Table 7). In the sample from Landlocked Tangle Lake, females matured at a slightly smaller size than males. Data from the lake trout population in Fielding Lake were too few for similar analysis.

To compare densities of mature lake trout from Sevenmile, Twobit, and Landlocked Tangle Lakes, the abundance estimates were reduced by the proportion of the fish sampled which were less than the LM_{50} for the population from each lake[1]. The abundance of mature lake trout in Sevenmile Lake was thus estimated at 382 fish. The estimated density was 11.9 fish per hectare. For Twobit Lake, the number of mature lake trout was estimated to be 786 with a density of 9.7 fish per hectare. The estimated abundance and density of mature lake trout in Landlocked Tangle Lake were 1,645 fish and 7.5 fish per hectare, respectively (Table 8).

Age at Maturity. The age at which 50% of the lake trout were mature (AM_{50}) in the sample from Paxson Lake is 5.3 years (males = 4.8, females = 6.0) (Table 9; Figure 9). In Summit Lake, the AM_{50} was 6.1 years (males = 5.7, females = 6.5). The AM_{50} for lake trout in Landlocked Tangle Lake was 10.1 years (males = 10.1, females = 9.9), and for Twobit Lake the AM_{50} was 10.1 years (males = 9.0, females = 10.5). Due to insufficient sample sizes, it was not possible to estimate the AM_{50} for lake trout from Sevenmile Lake. However, all fish age 4 and younger were immature, and all fish age 7 and older were mature. Approximately 50% of the age 5 fish were mature but no age 6 fish were sampled.

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[1] The proportion of mature fish in each sample was calculated by formula (3) and the variance of the proportion by formula (4). The estimate of the abundance of mature fish was calculated with formula (7) and the variance of the estimate (formula 8) is the variance of a product (Goodman 1960):

(7) $\hat{N}_m = \hat{p}\,\hat{N}$; and, (8) $V[\hat{N}_m] = \hat{p}^2\,V[\hat{N}] + V[\hat{p}]\,\hat{N}^2 - V[\hat{p}]\,V[\hat{N}]$;

where:

$\hat{N}$ = estimate of abundance of lake trout in each lake;

$\hat{N}_m$ = estimate of abundance of lake trout of mature size in each lake; and,

$\hat{p}$ = estimate of the proportion of mature fish in $\hat{N}$.

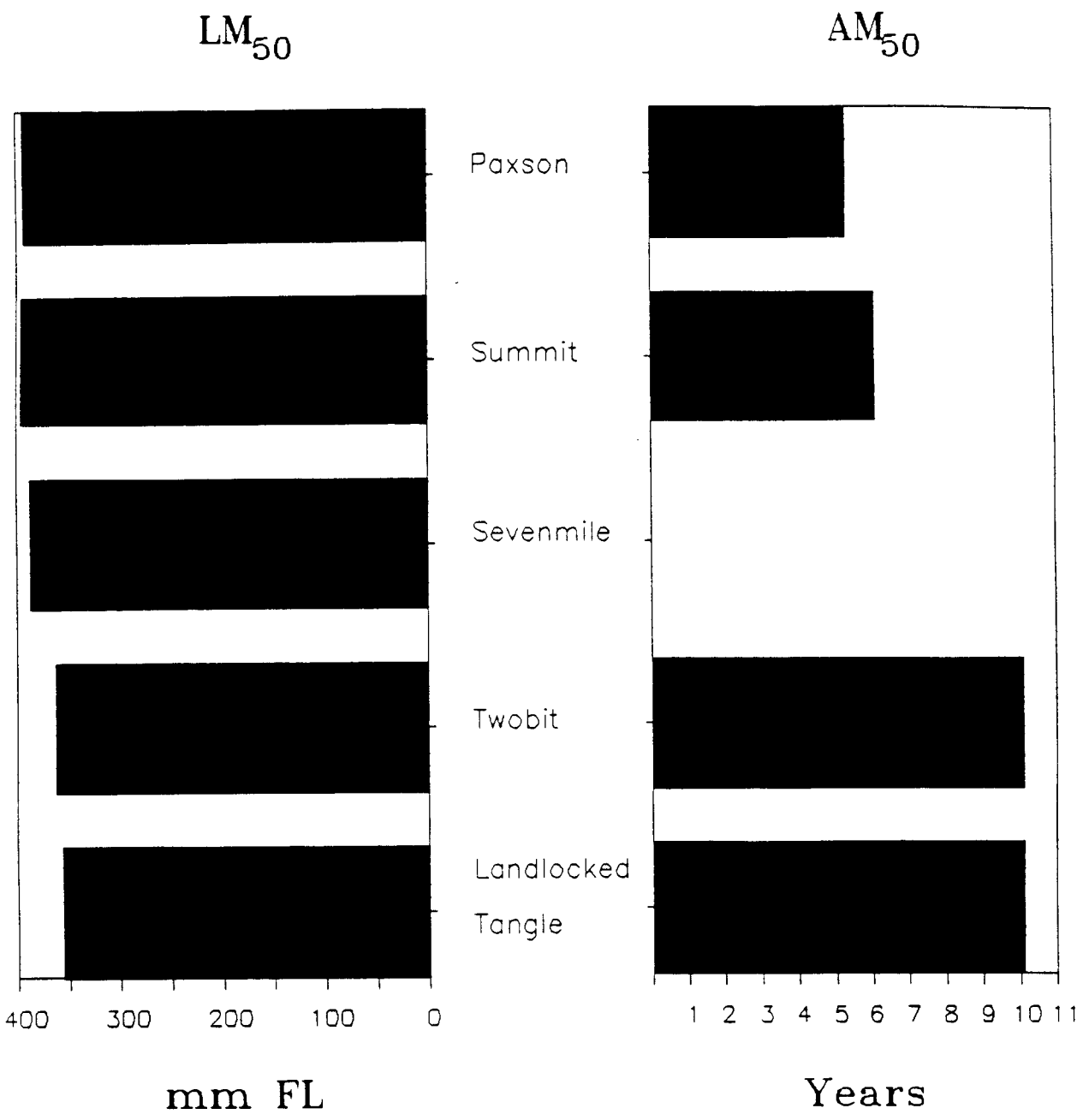

Figure 9. Estimated length at maturity (LM_{50}) and age at maturity (AM_{50}) of lake trout from Paxson, Summit, Sevenmile, Twobit, and Landlocked Tangle Lakes, 1987.

Table 7. The LM_{50}, LM_1, and LM_{99} and their fiducial limits for lake trout sampled from Paxson, Summit, Landlocked Tangle, Sevenmile and Twobit Lakes in 1987.

Lake	Sample Size	LM_{50}	95% Fiducial Limits		LM_1	95% Fiducial Limits		LM_{99}	95% Fiducial Limits	
			Lower	Upper		Lower	Upper		Lower	Upper
PAXSON										
Both	532	394	366	411	294	240	328	527	506	568
Females	179	457	435	472	380	326	408	550	527	602
Males	353	383	324	405	303	199	346	484	464	540
SUMMIT										
Both	193	396	328	429	294	168	346	532	484	702
Females	53	452	429	470	400	323	424	511	485	611
Males	127	361	318	389	258	188	300	506	468	580
LANDLOCKED TANGLE										
Both	133	357	345	369	271	237	292	470	439	535
Females	67	348	329	366	257	197	287	472	429	595
Males	62	363	347	380	288	228	313	459	423	578
SEVENMILE										
Both	59	388	371	405	347	280	366	433	412	534
Females	29	350 - 425								
Males	14	375 - 425								
TWOBIT										
Both	149	363	324	388	256	153	296	520	461	756
Females	84	370	341	391	243	159	284	565	497	793
Males	51	335	?	390	232	?	309	482	407	?

Table 8. Estimated abundance and density of mature lake trout in Sevenmile, Twobit, and Landlocked Tangle Lakes.

Lake	Abundance	SE	Density	Surface Area
Landlocked Tangle	1,645	359	7.5	219 ha
Glacier	1,724	403	10.0	172 ha
Twobit	786	141	9.7	81 ha
Sevenmile	382	73	11.9	32 ha

Table 9. The AM_{50}, AM_1, and AM_{99} and their fiducial limits for lake trout sampled from Paxson, Summit, Landlocked Tangle, Sevenmile and Twobit Lakes in 1987.

Lake	Sample Size	AM_{50}	95% Fiducial Limits		AM_1	95% Fiducial Limits		AM_{99}	95% Fiducial Limits	
			Lower	Upper		Lower	Upper		Lower	Upper
PAXSON										
Both	194	5.3	4.8	5.7	3.1	2.0	3.7	9.2	8.1	12.3
Females	98	6.0	5.4	6.6	3.8	2.3	4.6	9.5	8.2	14.7
Males	96	4.8	3.9	5.3	3.1	1.3	3.9	7.5	6.5	12.6
SUMMIT										
Both	110	6.1	5.7	6.6	4.3	3.2	4.9	8.8	7.7	12.0
Females	43	6.5	6.0	7.2	5.5	3.5	6.0	7.7	7.1	12.6
Males	60	5.7	4.9	6.5	3.8	1.9	4.5	8.6	7.2	16.6
LANLOCKED TANGLE										
Both	115	10.1	9.3	10.9	5.4	3.6	6.6	18.7	15.7	27.1
Females	61	9.9	8.8	11.0	5.7	3.0	7.0	17.3	14.2	31.3
Males	52	10.1	8.6	11.4	5.4	2.1	7.0	19.0	15.0	43.4
SEVENMILE										
Both	55	4 - 7	(NO AM_{50}'s are possible, all Age 4 and younger were immature;							
Females	28		all Age 7 and older were mature; partial maturity at Age 5							
Males	13		but NO Age 6 in samples)							
TWOBIT										
Both	148	10.1	9.3	10.8	5.7	4.3	6.6	18.0	15.7	22.7
Females	83	10.5	9.3	11.7	5.2	3.1	6.6	21.1	17.2	33.0
Males	51	9.0	7.4	10.1	5.9	2.8	7.3	13.8	11.9	22.5

Size at Age:

Estimates of the mean length at age of lake trout sampled from Landlocked Tangle, Fielding, Paxson, Sevenmile, Summit, and Twobit Lakes are given in Appendix Tables II.1 - II.6. Lake trout in the samples from Paxson Lake (n = 229) and Summit Lake (n = 132) grew fastest and attained the largest size of any of the lakes sampled. Growth of lake trout from Fielding Lake was similar to the growth seen in the younger age classes of fish from Paxson and Summit Lakes, but no fish older than age 13 were present in our sample (n = 49). Lengths at age for lake trout from Sevenmile Lake indicate growth rates faster than for fish from Landlocked Tangle and Twobit Lakes but slower than the rates of lake trout from Fielding, Paxson, and Summit Lakes. Lake trout were the smallest at age in the samples from Landlocked Tangle and Twobit Lakes. Estimates of length at age for fish from Landlocked Tangle and Twobit Lakes are very similar.

DISCUSSION

Population Abundance Estimates

Abundance of mature lake trout in lakes for which estimates were performed in 1987 ranged from 7.5 fish per hectare in Landlocked Tangle Lake to 12.4 fish per hectare in Sevenmile Lake. Burr (1987b) estimated abundance of mature lake trout (>373 mm FL) in Glacier Lake (172 ha) to be 1,724 fish or 10.0 fish per hectare (Table 8). However, comparable estimates of lake trout density from other areas of Alaska are not available. The few estimates available from other geographical areas indicate that most lake trout stock densities are between 1 and 14 fish per hectare (Martin and Olver 1980). The estimated stock of mature lake trout (age 6 and older) in Swan Lake, Alberta, calculated from mark-recapture experiments was 226 fish or 1.13 fish per hectare for this 200 ha lake (Paterson 1968). In the much larger Thompson Lake, Maine (1,791 ha), the estimated abundance of lake trout larger than 356 mm was 19,252, or 10.7 fish per hectare (De Roche unpublished, from Martin and Olver 1980). The estimates of lake trout densities from the four lakes in Alaska which range from 7.5 to 12.4 fish per hectare therefore, lie in the middle to upper range of reported densities.

Densities of lake trout in the four lakes from Alaska show an inverse relationship with lake surface area (Table 8). An inverse relationship with density and or yield and lake area is consistent with reports by Carlander (1977), Goddard et al. (1987) and others. This implies that smaller lakes produce more fish than larger lakes on a per unit area basis. Such a trend is intuitively reasonable since larger lakes generally have a greater proportion of deep, relatively less productive habitat than smaller lakes.

However, abundance in numbers does not necessarily correlate well with the biomass of a population. For example, planktivorous and piscivorous populations of lake trout of equivalent biomass may differ widely in abundance because of the typically small average size of the planktivorous fish. Martin and Olver (1980) report that the densest stocks of lake trout generally occur in those lakes where fish mature at a small size, are planktivorous, and where

the average size of fish is between 300-400 mm. Hence the relatively high densities of lake trout found in the four lakes in Alaska is likely related to the small surface area of the lakes studied, the small average size of fish, and the small size at maturity of lake trout in these populations.

Population Structure

Data collected in 1987 from the populations of lake trout from the six study lakes have provided estimates of the population structure (sex, size, and age composition, and maturity) for each lake trout population. However, in many cases the sample sizes were too small to provide conclusive comparisons, particularly for estimates of age composition and size at age. ADF&G will continue to collect data from the populations in each of these lakes from creel census contacts and from test netting. These data will be accumulated across years and added to the existing data base to improve the accuracy and precision of the estimates of population structure.

Lake trout stocks usually exhibit balanced sex ratios (Martin and Olver 1980). A balanced sex ratio is seen when all samples are considered from Landlocked Tangle Lake. However, males were more common in the adjusted estimate for Landlocked Tangle Lake and in the samples from Paxson and Summit Lakes. The adjusted estimate was made from a relatively small sample (n = 25). A possible explanation for the skewed sex ratios from Paxson and Summit Lake is that a large proportion of the samples were collected from the spawning grounds where a preponderance of males has been found in most other studies (Martin and Olver 1980). When the samples collected in September are removed from the estimates of sex composition, a much more balanced sex ratio is seen (Table 4). The preponderance of females sampled from Fielding Lake is most likely a result of the sample size (n = 14).

The size composition of lake trout populations estimated as Relative Stock Density (RSD) are similar for the populations of lake trout from Landlocked Tangle, Sevenmile, and Twobit Lakes. In each of these lakes, very few fish of large size were found and nearly all of the lake trout sampled were less than 495 mm FL ("Stock"). In contrast, much larger lake trout occurred in the samples from Paxson and Summit Lakes. The size composition of lake trout from Fielding Lake is between these two extremes. However, the RSD from Fielding Lake is more similar to the size structure of the other three lakes of the Tanana River system than those of the Copper River drainage lakes.

The age composition of sport caught lake trout from Fielding, Paxson, and Summit Lakes show a dominance of younger fish (ages 5-8). Estimates of the age composition of the population from each of these lakes show a similar distribution of ages to those from the sport harvest. Relatively old lake trout (age > 25) were sampled from the populations of Paxson and Summit Lakes of the Copper River system and from the relatively remote Landlocked Tangle, and Twobit Lakes of the Tanana River system. In contrast, the maximum ages of lake trout from Fielding and Sevenmile Lakes were 13 and 14, respectively. Both of these lakes have good road access. The absence of age 6 fish from the samples from Sevenmile Lake indicates reproductive failure in this year class.

Lake trout from Paxson and Summit Lakes (Copper River system) are larger and mature at a larger size and at a younger age than do lake trout from lakes of the Tanana River system. The faster growth of lake trout in Paxson and Summit Lakes is probably a result of the availability of large numbers of sockeye salmon fry and smolt and, to a lesser degree, round and humpback whitefish and Arctic grayling which provide an excellent forage base. In contrast, lake trout are essentially the only fish species in Twobit Lake where their diet is composed primarily of snails and aquatic invertebrates. Whitefish and other fish species are present in the other sampled Tanana River drainage lakes, but sockeye salmon are absent. Lake trout from Landlocked Tangle, Sevenmile, and Twobit Lakes are mostly small, and they mature at a small size. In Landlocked Tangle and Twobit Lakes, which have relatively poor access, older age classes are present and lake trout in these populations mature at an older age. Older age classes are absent from samples from Sevenmile Lake, a lake with excellent road access. Lake trout in this population mature at a younger age. Though data are few, the possibility exists that older age classes at Sevenmile Lake have been harvested by anglers and that a compensatory decrease in age at maturity has resulted.

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APPENDICES

Appendix Table I.1. Estimated age composition of the lake trout population in Fielding Lake, 1986-87.

AGE (years)	CREEL CENSUS					TEST NETTING					ALL LAKE TROUT				
	Males	Females	Both Sexes			Males	Females	Both Sexes			Males	Females	Both Sexes		
	n[1]	n	n	%	SE	n	n	n	%	SE	n	n	n	%	SE
0	0	0	0	0		0	0	0	0		0	0	0	0	
1	0	0	0	0		0	0	0	0		0	0	0	0	
2	0	0	0	0		0	0	0	0		0	0	0	0	
3	0	0	0	0		0	0	0	0		0	0	0	0	
4	0	1	4	10	4.7	0	0	0	0		0	1	4	8	3.8
5	1	0	4	10	4.7	0	0	4	40	16.3	1	0	8	16	5.1
6	0	1	11	27	7.0	1	1	3	30	15.3	1	2	14	27	6.3
7	0	1	11	27	7.0	0	1	1	10	10.0	0	2	12	24	6.0
8	0	1	6	15	5.6	0	0	0	0		0	1	6	12	4.6
9	0	0	2	5	3.4	0	1	1	10	10.0	0	1	3	6	3.3
10	0	0	0	0		1	0	1	10	10.0	1	0	1	2	2.0
11	0	0	1	2	2.4	0	0	0	0		0	0	1	2	2.0
12	0	0	0	0		0	0	0	0		0	0	0	0	
13	0	1	2	5	3.4	0	0	0	0		0	1	2	4	2.7
14	0	0	0	0		0	0	0	0		0	0	0	0	
15	0	0	0	0		0	0	0	0		0	0	0	0	
16	0	0	0	0		0	0	0	0		0	0	0	0	
17	0	0	0	0		0	0	0	0		0	0	0	0	
18	0	0	0	0		0	0	0	0		0	0	0	0	
19	0	0	0	0		0	0	0	0		0	0	0	0	
20	0	0	0	0		0	0	0	0		0	0	0	0	
21	0	0	0	0		0	0	0	0		0	0	0	0	
22	0	0	0	0		0	0	0	0		0	0	0	0	
23	0	0	0	0		0	0	0	0		0	0	0	0	
24	0	0	0	0		0	0	0	0		0	0	0	0	
25	0	0	0	0		0	0	0	0		0	0	0	0	
26	0	0	0	0		0	0	0	0		0	0	0	0	
27	0	0	0	0		0	0	0	0		0	0	0	0	
28	0	0	0	0		0	0	0	0		0	0	0	0	
29	0	0	0	0		0	0	0	0		0	0	0	0	
30	0	0	0	0		0	0	0	0		0	0	0	0	
31	0	0	0	0		0	0	0	0		0	0	0	0	
32	0	0	0	0		0	0	0	0		0	0	0	0	
33	0	0	0	0		0	0	0	0		0	0	0	0	
34	0	0	0	0		0	0	0	0		0	0	0	0	
35	0	0	0	0		0	0	0	0		0	0	0	0	
36	0	0	0	0		0	0	0	0		0	0	0	0	
ALL	1	5	41			2	3	10			3	8	51		

[1] n = sample size

Appendix Table I.2. Estimated age composition of the lake trout population in Paxson Lake, 1986-87.

AGE (years)	CREEL CENSUS					TEST NETTING					ALL LAKE TROUT				
	Males	Females	Both Sexes			Males	Females	Both Sexes			Males	Females	Both Sexes		
	n[1]	n	n	%	SE	n	n	n	%	SE	n	n	n	%	SE
0	0	0	0	0		0	0	0	0		0	0		0	0.0
1	0	0	0	0		0	0	0	0		0	0		0	0.0
2	0	0	0	0		0	0	0	0		0	0		0	0.0
3	0	0	0	0		0	0	0	0		0	0		0	0.0
4	2	1	4	3	1.5	0	0	0	0		2	1	4	2	0.9
5	15	7	27	20	3.5	4	2	6	6	2.5	19	9	33	14	2.3
6	10	13	30	22	3.6	3	6	9	9	3.0	13	19	39	17	2.5
7	7	4	12	9	2.5	12	3	15	16	3.8	19	7	27	12	2.1
8	1	5	9	7	2.2	7	5	12	13	3.4	8	10	21	9	1.9
9	1	3	5	4	1.6	3	2	5	5	2.3	4	5	10	4	1.4
10	0	0	0	0		3	3	6	6	2.5	3	3	6	3	1.1
11	3	2	6	4	1.8	0	4	4	4	2.1	3	6	10	4	1.4
12	2	2	4	3	1.5	0	1	1	1	1.1	2	3	5	2	1.0
13	4	2	6	4	1.8	4	1	5	5	2.3	8	3	11	5	1.4
14	0	2	2	1	1.1	0	2	2	2	1.5	0	4	4	2	0.9
15	2	2	5	4	1.6	2	3	5	5	2.3	4	5	10	4	1.4
16	1	1	2	1	1.1	1	3	4	4	2.1	2	4	6	3	1.1
17	1	0	1	1	0.7	3	3	6	6	2.5	4	3	7	3	1.1
18	1	1	2	1	1.1	0	0	0	0		1	1	2	1	0.6
19	2	1	5	4	1.6	1	2	3	3	1.8	3	3	8	3	1.2
20	0	1	1	1	0.7	0	1	1	1	1.1	0	2	2	1	0.6
21	2	0	3	2	1.3	3	1	4	4	2.1	5	1	7	3	1.1
22	1	0	1	1	0.7	0	2	2	2	1.5	1	2	3	1	0.8
23	0	3	3	2	1.3	0	0	0	0		0	3	3	1	0.8
24	0	2	2	1	1.1	1	1	2	2	1.5	1	3	4	2	0.9
25	0	0	0	0		0	0	0	0		0	0		0	0.0
26	0	0	1	1	0.7	1	0	1	1	1.1	1	0	2	1	0.6
27	0	0	0	0		1	0	1	1	1.1	1	0	1	0	0.4
28	0	0	0	0		0	1	1	1	1.1	0	1	1	0	0.4
29	0	1	2	1	1.1	0	0	0	0		0	1	2	1	0.6
30	0	0	0	0		0	0	0	0		0	0		0	0.0
31	0	0	0	0		0	0	0	0		0	0		0	0.0
32	0	0	0	0		0	0	0	0		0	0		0	0.0
33	0	1	1	1	0.7	0	0	0	0		0	1	1	0	0.4
34	0	0	0	0		0	0	0	0		0	0		0	0.0
35	0	0	0	0		0	0	0	0		0	0		0	0.0
36	0	0	0	0		0	0	0	0		0	0		0	0.0
ALL	55	54	134			49	46	95			104	100	229		

[1] n = sample size

Appendix Table I.3. Estimated age composition of the lake trout population in Summit Lake, 1986-87.

AGE (years)	CREEL CENSUS					TEST NETTING					ALL LAKE TROUT				
	Males	Females	Both Sexes			Males	Females	Both Sexes			Males	Females	Both Sexes		
	n[1]	n	n	%	SE	n	n	n	%	SE	n	n	n	%	SE
0	0	0	0	0		0	0	0	0		0	0	0	0	
1	0	0	0	0		0	0	3	3	1.6	0	0	3	2	1.3
2	0	0	0	0		0	1	3	3	1.6	0	1	3	2	1.3
3	0	0	0	0		0	1	2	2	1.3	0	1	2	2	1.1
4	0	0	2	8	5.3	5	8	13	12	3.2	5	8	15	11	2.8
5	1	0	5	19	7.9	7	4	12	11	3.1	8	4	17	13	2.9
6	1	3	8	31	9.2	5	7	12	11	3.1	6	10	20	15	3.1
7	0	0	1	4	3.8	6	6	12	11	3.1	6	6	13	10	2.6
8	0	0	0	0		3	3	6	6	2.2	3	3	6	5	1.8
9	0	0	0	0		3	0	3	3	1.6	3	0	3	2	1.3
10	2	1	3	12	6.4	1	1	2	2	1.3	3	2	5	4	1.7
11	1	1	2	8	5.3	2	0	2	2	1.3	3	1	4	3	1.5
12	0	0	0	0		5	0	5	5	2.0	5	0	5	4	1.7
13	1	0	2	8	5.3	2	0	2	2	1.3	3	0	4	3	1.5
14	0	0	0	0		1	0	1	1	0.9	1	0	1	1	0.8
15	0	0	0	0		1	1	2	2	1.3	1	1	2	2	1.1
16	0	0	0	0		1	1	2	2	1.3	1	1	2	2	1.1
17	0	0	1	4	3.8	2	2	4	4	1.8	2	2	5	4	1.7
18	0	1	1	4	3.8	2	2	4	4	1.8	2	3	5	4	1.7
19	1	0	1	4	3.8	2	0	2	2	1.3	3	0	3	2	1.3
20	0	0	0	0		6	1	7	7	2.4	6	1	7	5	1.9
21	0	0	0	0		0	0	0	0		0	0	0	0	
22	0	0	0	0		1	0	1	1	0.9	1	0	1	1	0.8
23	0	0	0	0		2	1	3	3	1.6	2	1	3	2	1.3
24	0	0	0	0		1	0	1	1	0.9	1	0	1	1	0.8
25	0	0	0	0		0	1	1	1	0.9	0	1	1	1	0.8
26	0	0	0	0		0	0	0	0		0	0	0	0	
27	0	0	0	0		0	1	1	1	0.9	0	1	1	1	0.8
28	0	0	0	0		0	0	0	0		0	0	0	0	
29	0	0	0	0		0	0	0	0		0	0	0	0	
30	0	0	0	0		0	0	0	0		0	0	0	0	
31	0	0	0	0		0	0	0	0		0	0	0	0	
32	0	0	0	0		0	0	0	0		0	0	0	0	
33	0	0	0	0		0	0	0	0		0	0	0	0	
34	0	0	0	0		0	0	0	0		0	0	0	0	
35	0	0	0	0		0	0	0	0		0	0	0	0	
36	0	0	0	0		1	0	1	1	0.9	1	0	1	1	0.8
ALL	7	6	26			59	41	107			66	47	133		

[1] n = sample size

Appendix Table I.4. Distribution of ages from all lake trout samples collected from Landlocked Tangle Lake in 1987 and estimated age composition of the population after adjustment for gear bias.

AGE (years)	ALL SAMPLES					SAMPLES FROM AUGUST						POPULATION AGE COMPOSITION		
	Males	Females	Both Sexes			≥400mm Both Sexes			¢400mm Both Sexes			Both Sexes		
	n[1]	n	n	%	SE	n	p[2]	Var[p]	n	p	Var[p]	n	%	SE
0	0	0	0	0	0.0	0	0	0	0	0	0	--	0.0	--
1	1	0	1	1	0.8	1	0.05	0.00	0	0	0	--	5.0	5
2	0	0	0	0	0.0	0	0	0	0	0	0	--	0.0	--
3	0	0	0	0	0.0	0	0	0	0	0	0	--	0.0	--
4	0	0	0	0	0.0	0	0	0	0	0	0	--	0.0	--
5	0	0	0	0	0.0	0	0	0	0	0	0	--	0.0	--
6	2	0	3	2	1.3	1	0.05	0.00	0	0	0	--	5.0	5
7	1	0	2	2	1.1	1	0.05	0.00	0	0	0	--	5.0	5
8	5	8	17	13	3.0	2	0.11	0.00	0	0	0	--	10.0	7
9	4	15	21	16	3.3	3	0.16	0.00	0	0	0	--	15.0	8
10	8	4	13	10	2.7	2	0.11	0.00	0	0	0	--	10.0	7
11	10	9	20	16	3.2	5	0.27	0.01	0	0	0	--	24.9	10
12	4	4	8	6	2.1	2	0.11	0.00	0	0	0	--	10.0	7
13	4	4	9	7	2.3	0	0	0	0	0	0	--	0.0	--
14	3	3	6	5	1.9	0	0	0	0	0	0	--	0.0	--
15	2	2	4	3	1.5	0	0	0	0	0	0	--	0.0	--
16	2	1	3	2	1.3	0	0	0	0	0	0	--	0.0	--
17	1	3	4	3	1.5	0	0	0	0	0	0	--	0.0	--
18	2	1	3	2	1.3	1	0.05	0.00	0	0	0	--	5.0	5
19	0	2	2	2	1.1	0	0	0	1	0.14	0.02	--	1.5	2
20	0	3	3	2	1.3	0	0	0	1	0.14	0.02	--	1.5	2
21	1	2	3	2	1.3	0	0	0	0	0	0	--	0.0	--
22	1	0	1	1	0.8	0	0	0	0	0	0	--	0.0	--
23	0	1	2	2	1.1	0	0	0	2	0.28	0.03	--	2.9	2
24	0	0	0	0	0.0	0	0	0	0	0	0	--	0.0	--
25	0	1	1	1	0.8	0	0	0	1	0.14	0.02	--	1.5	2
26	1	1	3	2	1.3	0	0	0	2	0.28	0.03	--	2.9	2
27	0	0	0	0	0.0	0	0	0	0	0	0	--	0.0	--
28	0	0	0	0	0.0	0	0	0	0	0	0	--	0.0	--
29	0	0	0	0	0.0	0	0	0	0	0	0	--	0.0	--
30	0	0	0	0	0.0	0	0	0	0	0	0	--	0.0	--
31	0	0	0	0	0.0	0	0	0	0	0	0	--	0.0	--
32	0	0	0	0	0.0	0	0	0	0	0	0	--	0.0	--
33	0	0	0	0	0.0	0	0	0	0	0	0	--	0.0	--
34	0	0	0	0	0.0	0	0	0	0	0	0	--	0.0	--
35	0	0	0	0	0.0	0	0	0	0	0	0	--	0.0	--
36	0	0	0	0	0.0	0	0	0	0	0	0	--	0.0	--
ALL	52	64	129			18			7			25		

[1] n = sample size

[2] p = proportion

Appendix Table I.5. Estimated age composition of the lake trout population in Sevenmile Lake, 1986-87.

AGE (years)	ALL LAKE TROUT				
	Males	Females	Both Sexes		
	n1	n	n	%	SE
0	0	7	8	12	4
1	0	3	6	9	4
2	1	0	3	5	3
3	1	2	3	5	3
4	1	10	12	18	5
5	3	8	11	17	5
6	0	0	0	0	
7	4	0	5	8	3
8	0	2	3	5	3
9	2	1	4	6	3
10	1	1	2	3	2
11	1	1	2	3	2
12	0	0	1	2	2
13	0	3	3	5	3
14	1	1	2	3	2
15	0	0	0	0	
16	0	0	0	0	
17	0	0	0	0	
18	0	0	0	0	
19	0	0	0	0	
20	0	0	0	0	
21	0	0	0	0	
22	0	0	0	0	
23	0	0	0	0	
24	0	0	0	0	
25	0	0	0	0	
26	0	0	0	0	
27	0	0	0	0	
28	0	0	0	0	
29	0	0	0	0	
30	0	0	0	0	
31	0	0	0	0	
32	0	0	0	0	
33	0	0	0	0	
34	0	0	0	0	
35	0	0	0	0	
36	0	0	0	0	
ALL	15	39	65		

1 n = sample size

Appendix Table I.6. Estimated age composition of the lake trout population in Twobit Lake 1986-87.

AGE (years)	ALL LAKE TROUT				
	Males	Females	Both Sexes		
	n1	n	n	%	SE
0	0	0	0	0	
1	0	0	0	0	
2	0	0	0	0	
3	0	0	0	0	
4	0	0	0	0	
5	1	1	3	2	1
6	1	0	6	4	2
7	2	8	13	8	2
8	4	8	14	9	2
9	4	9	15	10	2
10	4	4	10	6	2
11	0	5	5	3	1
12	10	9	19	12	3
13	5	6	11	7	2
14	6	7	13	8	2
15	1	4	5	3	1
16	2	3	5	3	1
17	3	4	7	5	2
18	2	5	7	5	2
19	3	4	7	5	2
20	1	1	2	1	1
21	2	1	3	2	1
22	1	1	2	1	1
23	0	3	3	2	1
24	0	0	0	0	
25	0	2	2	1	1
26	0	1	1	1	1
27	0	0	0	0	
28	0	1	1	1	1
29	0	0	0	0	
30	1	0	1	1	1
31	0	0	0	0	
32	0	0	0	0	
33	0	0	0	0	
34	0	0	0	0	
35	0	0	0	0	
36	0	0	0	0	
ALL	53	87	155		

1 n = sample size

Appendix Table II.1. Estimated length (mm FL) at age (from otoliths) of lake trout from Paxson Lake, 1987.

AGE	ALL LAKE TROUT			FEMALE LAKE TROUT			MALE LAKE TROUT			CREEL CENSUS		
	mean length	sample size	SE	mean length	sample size	SE	mean length	sample size	SE	mean length	sample size	SE
0		0			0			0			0	
1		0			0			0			0	
2		0			0			0			0	
3		0			0			0			0	
4	377	4	9	390	1		364	2	14	377	4	9
5	413	33	4	398	9	8	423	19	5	409	27	4
6	445	39	6	445	19	10	436	13	7	447	30	7
7	467	27	9	493	7	16	455	19	10	487	12	15
8	488	21	9	510	10	11	465	8	14	513	9	13
9	496	10	11	508	5	11	470	4	18	524	5	8
10	515	6	30	568	3	32	463	3	26		0	
11	557	10	12	568	6	20	542	3	9	555	6	10
12	544	5	27	570	3	13	505	2	65	544	4	35
13	603	11	33	557	3	17	621	8	45	656	6	53
14	627	4	46	627	4	46		0		686	2	77
15	565	10	6	558	5	9	564	4	6	574	5	9
16	595	6	21	619	4	20	546	2	26	583	2	11
17	571	7	7	572	3	12	570	4	10	561	1	
18	591	2	11	580	1		601	1		591	2	11
19	618	8	34	666	3	93	582	3	20	595	5	7
20	618	2	9	618	2	9		0		609	1	
21	549	7	9	583	1		543	5	9	549	3	11
22	569	3	5	568	2	8	572	1		572	1	
23	695	3	97	695	3	97		0		695	3	97
24	731	4	78	766	3	98	625	1		758	2	170
25		0			0			0			0	
26	613	2	52		0		561	1		665	1	
27	550	1			0		550	1			0	
28	652	1		652	1			0			0	
29	583	2	13	570	1			0		583	2	13
30		0			0			0			0	
31		0			0			0			0	
32		0			0			0			0	
33	610	1		610	1			0		610	1	
34		0			0			0			0	
35		0			0			0			0	
36		0			0			0			0	
ALL	507	229	6	532	100	10	487	104	8	504	134	9

Appendix Table II.2. Estimated length (mm FL) at age (from otoliths) of lake trout from Summit Lake, 1987.

AGE	ALL LAKE TROUT			FEMALE LAKE TROUT			MALE LAKE TROUT			CREEL CENSUS		
	mean length	sample size	SE	mean length	sample size	SE	mean length	sample size	SE	mean length	sample size	SE
0		0			0			0			0	
1	120	6	3		0			0			0	
2	151	1		151	1			0			0	
3	267	2	25	242	1			0			0	
4	291	15	11	296	8	17	266	5	12	335	2	15
5	349	17	14	314	4	23	353	8	24	383	5	14
6	444	18	10	438	10	10	444	6	15	460	6	22
7	464	13	9	463	6	11	469	6	15	450	1	
8	499	6	16	518	3	18	480	3	25		0	
9	498	3	7		0		498	3	7		0	
10	529	5	17	550	2	35	514	3	18	549	3	18
11	513	4	13	530	1		507	3	16	533	2	3
12	546	5	32		0		546	5	32		0	
13	493	4	19		0		507	3	18	495	2	45
14	494	1			0		494	1			0	
15	524	2	21	503	1		545	1			0	
16	574	2	74	648	1		500	1			0	
17	553	5	41	503	2	12	579	2	112	600	1	
18	603	5	76	686	3	102	478	2	2	810	1	
19	544	3	14		0		544	3	14	570	1	
20	569	7	31	686	1		550	6	28		0	
21		0			0			0			0	
22	490	1			0		490	1			0	
23	508	3	17	539	1		493	2	12		0	
24	497	1			0		497	1			0	
25	872	1		872	1			0			0	
26		0			0			0			0	
27	503	1		503	1			0			0	
28		0			0			0			0	
29		0			0			0			0	
30		0			0			0			0	
31		0			0			0			0	
32		0			0			0			0	
33		0			0			0			0	
34		0			0			0			0	
35		0			0			0			0	
36	505	1			0		505	1			0	
ALL	440	132	12	450	47	22	469	66	12	478	24	22

Appendix Table II.3. Estimated length (mm FL) at age (from otoliths) of lake trout from Fielding Lake, 1987.

AGE	ALL LAKE TROUT			FEMALE LAKE TROUT			MALE LAKE TROUT			CREEL CENSUS		
	mean length	sample size	SE	mean length	sample size	SE	mean length	sample size	SE	mean length	sample size	SE
0		0			0			0			0	
1		0			0			0			0	
2		0			0			0			0	
3		0			0			0			0	
4	307	4	9	284	1			0		307	4	9
5	352	8	20		0		470	1		395	4	25
6	409	12	12	438	2	17	471	1		400	9	13
7	435	12	10	447	2	20		0		432	11	11
8	480	6	28	597	1			0		480	6	28
9	537	3	28	547	1			0		532	2	49
10	482	1			0		482	1			0	
11	647	1			0			0		647	1	
12		0			0			0			0	
13	700	2	6	705	1			0		700	2	6
14		0			0			0			0	
15		0			0			0			0	
16		0			0			0			0	
17		0			0			0			0	
18		0			0			0			0	
19		0			0			0			0	
20		0			0			0			0	
21		0			0			0			0	
22		0			0			0			0	
23		0			0			0			0	
24		0			0			0			0	
25		0			0			0			0	
26		0			0			0			0	
27		0			0			0			0	
28		0			0			0			0	
29		0			0			0			0	
30		0			0			0			0	
31		0			0			0			0	
32		0			0			0			0	
33		0			0			0			0	
34		0			0			0			0	
35		0			0			0			0	
36		0			0			0			0	
ALL	432	49	14	488	8	45	474	3	4	440	39	16

Appendix Table II.4. Estimated length (mm FL) at age (from otoliths) of lake trout from Landlocked Tangle Lake, 1987.

AGE	ALL LAKE TROUT			FEMALE LAKE TROUT			MALE LAKE TROUT		
	mean length	sample size	SE	mean length	sample size	SE	mean length	sample size	SE
0		0			0			0	
1	163	1			0		163	1	
2		0			0			0	
3		0			0			0	
4		0			0			0	
5		0			0			0	
6	274	3	15		0		268	2	23
7	287	2	23		0		264	1	
8	311	16	5	309	8	8	311	4	14
9	318	21	3	319	15	4	319	4	5
10	331	11	5	325	4	13	335	7	5
11	340	20	6	333	9	9	345	10	8
12	341	7	10	348	3	17	336	4	13
13	380	9	13	360	4	13	414	4	6
14	398	6	4	399	3	5	396	3	7
15	395	4	6	396	2	10	393	2	10
16	406	3	17	402	1		408	2	30
17	403	4	5	404	3	6	398	1	
18	391	3	14	403	1		385	2	22
19	413	1		413	1			0	
20	406	3	1	406	3	1		0	
21	420	3	14	429	2	19	402	1	
22	419	1			0		419	1	
23	442	2	10	452	1			0	
24		0			0			0	
25	424	1		424	1			0	
26	428	3	11	422	1		413	1	
27		0			0			0	
28		0			0			0	
29		0			0			0	
30		0			0			0	
31		0			0			0	
32		0			0			0	
33		0			0			0	
34		0			0			0	
35		0			0			0	
36		0			0			0	
ALL	349	124	4	352	62	6	349	50	7

Appendix Table II.5. Estimated length (mm FL) at age (from otoliths) of lake trout from Sevenmile Lake, 1987.

AGE	ALL LAKE TROUT			FEMALE LAKE TROUT			MALE LAKE TROUT		
	mean length	sample size	SE	mean length	sample size	SE	mean length	sample size	SE
0	86	8	0		0			0	
1	137	6	15	173	2	3		0	
2	214	3	20		0		254	1	
3	345	3	3	344	2	4	347	1	
4	324	12	12	316	10	13	382	1	
5	376	11	10	371	8	12	390	3	18
6		0			0			0	
7	405	4	9		0		405	4	9
8	423	3	2	423	2	3		0	
9	408	4	19	457	1		388	2	24
10	418	2	1	417	1		418	1	
11	427	2	5	432	1		422	1	
12	458	1			0			0	
13	444	3	14	444	3	14		0	
14	449	2	4	452	1		445	1	
15		0			0			0	
16		0			0			0	
17		0			0			0	
18		0			0			0	
19		0			0			0	
20		0			0			0	
21		0			0			0	
22		0			0			0	
23		0			0			0	
24		0			0			0	
25		0			0			0	
26		0			0			0	
27		0			0			0	
28		0			0			0	
29		0			0			0	
30		0			0			0	
31		0			0			0	
32		0			0			0	
33		0			0			0	
34		0			0			0	
35		0			0			0	
36		0			0			0	
ALL	347	56	13	358	31	14	389	15	12

Appendix Table II.6. Estimated length (mm FL) at age (from otoliths) of lake trout from Twobit Lake, 1987.

AGE	ALL LAKE TROUT			FEMALE LAKE TROUT			MALE LAKE TROUT		
	mean length	sample size	SE	mean length	sample size	SE	mean length	sample size	SE
0		0			0			0	
1		0			0			0	
2		0			0			0	
3		0			0			0	
4		0			0			0	
5	244	3	22	252	1		278	1	
6	261	6	8		0		283	1	
7	284	13	8	298	8	9	260	2	18
8	309	14	10	314	8	14	321	4	12
9	319	15	12	323	9	16	342	4	11
10	350	10	9	357	4	11	350	4	22
11	373	5	11	373	5	11		0	
12	380	19	7	374	9	10	385	10	10
13	375	11	8	375	6	12	374	5	11
14	396	13	8	398	7	10	394	6	14
15	384	5	8	391	4	5	357	1	
16	399	5	10	387	3	12	418	2	2
17	429	7	17	427	4	31	432	3	14
18	405	7	10	406	5	15	403	2	10
19	412	7	8	414	4	7	409	3	20
20	418	2	37	455	1		381	1	
21	406	3	15	377	1		421	2	7
22	414	2	9	422	1		405	1	
23	437	3	4	437	3	4		0	
24		0			0			0	
25	377	2	2	377	2	2		0	
26	413	1		413	1			0	
27		0			0			0	
28	485	1		485	1			0	
29		0			0			0	
30	422	1			0		422	1	
31		0			0			0	
32		0			0			0	
33		0			0			0	
34		0			0			0	
35		0			0			0	
36		0			0			0	
ALL	360	155	5	369	87	6	373	53	7

Appendix Table III.1. Length frequencies (listed by gear type and sampling period) of lake trout captured in Twobit Lake, 1987

SAMPLE PERIOD	FORK LENGTH[1]	GEAR TYPE: Gill Nets n[2]	Gill Nets %	Hoop Nets n	Hoop Nets %	Rod & Reel n	Rod & Reel %	All n	All %	RECAPTURED LAKE TROUT n	RECAPTURED LAKE TROUT %
Marking June, July	200	0	0	0	0	0	0	0	0		
	225	0	0	3	1	0	0	3	1		
	250	3	1	11	5	0	0	14	6		
	275	3	1	9	4	0	0	12	5		
	300	3	1	4	2	0	0	7	3		
	325	0	0	8	3	1	0	9	4		
	350	7	3	19	8	1	0	27	12		
	375	15	6	43	19	1	0	59	26		
	400	18	8	38	16	1	0	57	25		
	425	15	6	14	6	2	1	31	13		
	450	6	3	5	2	0	0	11	5		
	475	1	0	0	0	0	0	1	0		
	500	0	0	0	0	0	0	0	0		
	Total	71	31	154	67	6	3	231	100		
Recapture August, September	200	0	0	1	0	0	0	1	0	0	0
	225	3	1	6	3	0	0	9	4	0	0
	250	6	3	2	1	0	0	8	4	1	5
	275	5	2	3	1	0	0	8	4	0	0
	300	4	2	3	1	0	0	7	3	0	0
	325	14	7	5	2	0	0	19	9	0	0
	350	24	11	10	5	0	0	34	16	0	0
	375	34	16	14	7	0	0	48	22	11	50
	400	29	13	16	7	1	0.47	46	21	8	36
	425	17	8	9	4	0	0	26	12	2	9
	450	4	2	3	1	0	0	7	3	0	0
	475	0	0	1	0	0	0	1	0	0	0
	500	1	0	0	0	0	0	1	0	0	0
	Total	141	66	73	34	1	0.47	215	100	22	100

[1] upper limit of length category

[2] sample size

Appendix Table III.2a. Length frequencies (listed by gear type) of lake trout marked during June and July in Landlocked Tangle Lake, 1987.

FORK LENGTH[1]	GEAR TYPE											
	Gill Nets		Seine		Fyke Nets		Hoop Nets		Trot Lines		ALL	
	n[2]	%	n	%	n	%	n	%	n	%	n	%
200	0	0	0	0	0	0	0	0			0	0
225	0	0	0	0	0	0	0	0			0	0
250	2	1	0	0	0	0	0	0			2	1
275	1	1	3	6	0	0	0	0			4	2
300	1	1	6	12	0	0	1	4			8	3
325	12	7	3	6	1	17	3	12			19	8
350	28	16	18	35	0	0	7	28			53	20
375	56	32	13	25	4	67	2	8			75	29
400	33	19	4	8	1	17	9	36			47	18
425	22	13	3	6	0	0	1	4			26	10
450	15	9	2	4	0	0	2	8			19	7
475	3	2	0	0	0	0	0	0			3	1
500	1	1	0	0	0	0	0	0			1	0
525	0	0	0	0	0	0	0	0			0	0
550	0	0	0	0	0	0	0	0			0	0
575	0	0	0	0	0	0	0	0			0	0
600	1	1	0	0	0	0	0	0			1	0
625	0	0	0	0	0	0	0	0			0	0
650	0	0	0	0	0	0	0	0			0	0
675	0	0	0	0	0	0	0	0			0	0
700	0	0	0	0	0	0	0	0			0	0
725	0	0	0	0	0	0	0	0			0	0
750	0	0	0	0	0	0	0	0			0	0
775	0	0	0	0	0	0	0	0			0	0
800	1	1	0	0	0	0	0	0			1	0
TOTAL	176	67	52	20	6	2	25	10			259	100

[1] upper limit length category

[2] sample size

Appendix Table III.2b. Length frequencies (listed by gear type) of lake trout captured during August in Landlocked Tangle Lake, 1987.

FORK LENGTH[1]	GEAR TYPE											
	Gill Nets		Seine		Fyke Nets		Hoop Nets		Trot Lines		ALL	
	n[2]	%	n	%	n	%	n	%	n	%	n	%
200	0	0	0	0			0	0	0	0	0	0
225	0	0	0	0			1	6	0	0	1	0
250	6	4	0	0			1	6	0	0	7	3
275	9	5	0	0			1	6	0	0	10	4
300	15	9	2	5			0	0	0	0	17	7
325	24	15	4	10			4	22	0	0	32	14
350	36	22	8	20			6	33	0	0	50	21
375	26	16	11	28			1	6	0	0	38	16
400	17	10	9	23			2	11	1	7	29	12
425	13	8	4	10			1	6	3	21	21	9
450	13	8	1	3			1	6	4	29	19	8
475	6	4	1	3			0	0	3	21	10	4
500	0	0	0	0			0	0	0	0	0	0
525	0	0	0	0			0	0	0	0	0	0
550	0	0	0	0			0	0	0	0	0	0
575	0	0	0	0			0	0	2	14	2	1
600	0	0	0	0			0	0	0	0	0	0
625	0	0	0	0			0	0	0	0	0	0
650	0	0	0	0			0	0	1	7	1	0
675	0	0	0	0			0	0	0	0	0	0
700	0	0	0	0			0	0	0	0	0	0
725	0	0	0	0			0	0	0	0	0	0
750	0	0	0	0			0	0	0	0	0	0
775	0	0	0	0			0	0	0	0	0	0
800	0	0	0	0			0	0	0	0	0	0
Total	165	70	40	17			18	8	14	6	237	100

[1] upper limit length category
[2] sample size

Appendix Table III.2c. Length frequencies (listed by gear type) of lake trout recaptured during August in Landlocked Tangle Lake, 1987.

FORK LENGTH[1]	GEAR TYPE											
	Gill Nets		Seine		Fyke Nets		Hoop Nets		Trot Lines		ALL	
	n[2]	%	n	%	n	%	n	%	n	%	n	%
200	0	0	0	0			0	0	0	0	0	0
225	0	0	0	0			0	0	0	0	0	0
250	0	0	0	0			0	0	0	0	0	0
275	0	0	0	0			0	0	0	0	0	0
300	0	0	0	0			0	0	0	0	0	0
325	1	20	0	0			0	0	0	0	1	6
350	1	20	2	29			0	0	0	0	3	17
375	0	0	2	29			0	0	0	0	2	11
400	1	20	2	29			0	0	2	40	5	28
425	1	20	1	14			0	0	0	0	2	11
450	0	0	0	0			1	100	2	40	3	17
475	1	20	0	0			0	0	1	20	2	11
500	0	0	0	0			0	0	0	0	0	0
525	0	0	0	0			0	0	0	0	0	0
550	0	0	0	0			0	0	0	0	0	0
575	0	0	0	0			0	0	0	0	0	0
600	0	0	0	0			0	0	0	0	0	0
625	0	0	0	0			0	0	0	0	0	0
650	0	0	0	0			0	0	0	0	0	0
675	0	0	0	0			0	0	0	0	0	0
700	0	0	0	0			0	0	0	0	0	0
725	0	0	0	0			0	0	0	0	0	0
750	0	0	0	0			0	0	0	0	0	0
775	0	0	0	0			0	0	0	0	0	0
800	0	0	0	0			0	0	0	0	0	0
Total	5	28	7	39			1	6	5	28	18	100
Recapture Rate	5/165	3	7/40	18			1/18	6	5/14	36	18/23	8

[1] upper limit length category
[2] sample size